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EIGHTH MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

[*From our own Correspondents.*]

BEFORE we proceed formally to report proceedings, we cannot but observe, that the general arrangements have been excellent, and that so far as the officers and local members are concerned, nothing has been neglected which would tend to ensure a pleasant, a brilliant, and a profitable meeting. The commonalty, however, arguing from these expensive preliminaries, seem to have anticipated a Congress of Princes, or an aggregation of *millionnaires*, and, in many instances, increased the rent of their lodgings at least five hundred per cent. This absurd attempt at imposition, we are happy to say, was unsuccessful; by the advice of the local members it was resisted, and by their active exertions apartments were in numberless instances secured on reasonable terms. Still, the attempt should not be forgotten in making future arrangements. The best security, indeed, against its recurrence, is the fact that it failed on this occasion; but it must be guarded against, for if once successful, it would deter many valuable members from attending the meetings of the Association—the limited incomes of scientific men, generally, not admitting of these extravagancies.

If the prosperity of the Association can be judged of by the numbers enrolled, it goes on swimmingly. At the close of the Bristol Meeting there were 1350 members; at the close of the Liverpool Meeting 1840; whereas the tickets issued up to Wednesday night were 2350. As we concern ourselves principally with the scientific business of the Association, we shall merely record here, that the bustle of arrival began on Thursday and Friday, and that on Saturday about fifty members dined together at the Ordinary, Mr. J. Taylor, the Treasurer, in the chair, supported by Prof. Sedgwick, Dr. Robinson, of Armagh, Mr. Greenough, Dr. Richardson, the Rev. L. Jenyns, Rev. F. W. Hope, &c. On Sunday the Bishop of Durham preached a sermon, which was attended by many members of the Association. On Monday the Sectional Committees met at ten o'clock to prepare and arrange business, and at eleven the Sections opened:—Section A, *Mathematics and Physics*, in the Lecture Room of the Philosophical Society; B, *Chemistry and Mineralogy*, in the County Court; C, *Geology and Geography*, in the Music Hall; D, *Zoology and Botany*, in the County Court; E, *Anatomy and Medicine*, in Surgeons' Hall; F, *Statistics*, in the Old Academy of Arts; and G, *Mechanical Science*, in the Music Hall. At five o'clock about 750 Members sat down to dinner at the Ordinary, held in the Riding-school, which had been tastefully fitted up for the occasion, the Rev. W. Whewell in the chair, supported by the Bishop of Durham, the Marquis of Northampton, Sir John Herschel, Sir Charles Lemon, &c. After the customary toasts and speeches, the Members adjourned to the Central Exchange Rooms for public business; and the day concluded with a ball, given by the Mayoress, which was numerously attended, the Duke and Duchess of Northumberland, the Marquis of Northampton, and most of the distinguished members being present, and to which all, we believe, whose arrival was known, were politely invited. We ought not, perhaps, even to make mention of the Central Exchange Rooms, without adverting to the magnificent improvements in the city made by one enterprising and spirited individual, Mr. Grainger, who is said to have expended in this way more than a million and a half of money: Grey Street is hardly inferior to any street in the world—finer in its proportions and architectural character than Regent Street, although, of course, not of equal length; and the New Market is said to be without a rival in the kingdom.

SATURDAY, AUGUST 18.

ABOUT eighty members were present at the meeting, this day, of the General Committee. The Earl of Burlington being absent on the continent, Prof. Whewell, V.P. took the chair, and the Secretary, the Rev. Mr. Yates, read the Report of the proceedings of the Council during the past year.

The Report stated, that the Council, in addition to the old stock of 5,500*l.*, had purchased in the name of the Association, 1,000*l.*, in the three per cent. consols. It was recommended, that collectors should be appointed in places where meetings of the Association were in future held, and be allowed a per-centage on the subscriptions they received. The Council stated, that it had not fulfilled the recommendation of the Association, in procuring a report on the effects of Voltaic and Thermal Electricity in crystallization, &c. on account of the difficulty of finding a person fully qualified to superintend the inquiries and experiments necessary for the elucidation of such a subject. The question of international copyright it had resigned to Her Majesty's government, and it congratulated the Association on the recent passing of a law, so completely in accordance with the recommendations of the Association. The Council lamented the loss of two foreign members, Professor Moll, of Utrecht, (see *Athenæum*, No. 538), and Dr. Bowditch, of Boston, (see *Athenæum*, No. 557). It announced the election of two new Foreign Associates, Professors Dumas and Liebig. The astronomical observations made at Madras had been given for the use of the Association by the East India Company; and the reports of the tidal observations made at the expense of the Association had been placed in the custody of the Royal Society. The Council had taken into consideration the subject of petitioning Parliament to remit the assessed taxes on the buildings belonging to literary and philosophical institutions, and had resolved not to interfere in the matter. Finally, the Council, having devoted much attention to the laws regulating the constitution of the General Committee, and the several modifications proposed at different times, had prepared a project of law which would be submitted to the meeting.

After the reception of the Report, Prof. Phillips referred to the regulations made respecting the constitution of the General Committee at Liverpool, as detailed in our report of last year's proceedings. It was now proposed, that these should be repealed, and that the following laws should be substituted in their stead:—1. That there be five classes of persons eligible to the General Committee.—2. The first class to consist of the President, Vice Presidents, and other officers of the Association, past and present, and authors of reports, prepared by direction of the Association, and published under its sanction.—3. The second class to consist of members who have communicated any paper to a philosophical society, which has been published in its Transactions, on such a subject as is taken into consideration at the sectional meetings of the Association.—4. Office-bearers or delegates not exceeding three in number, from philosophical societies publishing Transactions, to constitute the third class.—5. Office-bearers or delegates not exceeding three in number from philosophical societies established in towns where the Association has met, or holds its meeting, to form the fourth class.—6. Foreigners and other distinguished individuals whose presence might be deemed advisable, nominated in writing by the President and the general secretaries, to form the fifth class.

The law No. 3, gave rise to considerable discussion; and it was finally resolved, that to the laws numbered 3, 4, and 5, there should be added—"the Council having the power to decide upon the interpretation of the law in all cases of doubt or difficulty." Two additional classes of persons were proposed to be admitted, viz. one delegate from every philosophical institution in Great Britain, and professors of science in universities; but both propositions were rejected without a division. Another class, Presidents and officers of sections, were declared admissible to the General Committee during their tenure of office.

The following gentlemen were chosen as a Committee of Recommendation.—The trustees and office-bearers of the Association; the Marquis of Northampton; Sirs D. Brewster, W. Hamilton, J. Robison, J. Herschel, and C. Lemon; Profs. Whewell, Willis, and Lloyd; Col. Sykes, Messrs. Baily, Owen, Lyell, and Greenough. The Committee then adjourned to Thursday at three o'clock.

MONDAY, AUGUST 20.

SECTION A.—MATHEMATICAL AND PHYSICAL SCIENCE.

President—Sir J. W. F. HERSCHEL, Bart.
Vice Presidents—Mr. FRANCIS BAILY, Sir DAVID BREWSTER, Sir W. ROWAN HAMILTON, K.H., Rev. Dr. ROBINSON.
Secretaries—Rev. Prof. CHEVALLIER, Major SABINE, R.A., Prof. STEVELLY.
Committee—Prof. Bache, of Philadelphia, Prof. Forbes, Mr. W. S. Harris, Major Jervis, Capt. Edward Johnson, R.N., Rev. Prof. Lloyd, Prof. Mac Cullagh, Prof. Nicholl, Rev. Prof. Peacock, Lieut.-Col. Reid, Capt. James Ross, R.N., Messrs. John Russell (Edinburgh), H. F. Talbot, Rev. W. Turner, jun., Prof. Wheatstone, Rev. W. Whewell, Rev. Prof. Whitley, Prof. Van Galen (Rotterdam).

The President, Sir John Herschel, on taking the chair, addressed the members, and observed, that he had been so long absent from the meetings of the Association, that he felt he must be to a great extent unacquainted with the forms and modes of proceeding of the Sections, as, in the infancy of the society, with which only he was personally acquainted, the meetings were, of course, not so numerously attended; and experience must have taught them the propriety of changing some of those modes of proceeding, to which his memory would still lead him back. He would therefore at once throw himself on the considerate kindness of the members, lest any combination of circumstances should arise, when his inexperience might require that indulgence. He felt a gratification which he should in vain attempt to express, at the extension of the Association, and its growing usefulness; and he anxiously looked forward to the time when its influence would be felt in every portion of the empire, and its effects throughout the entire globe. The Committee had decided on the order of proceedings for the Section, and, in respect to the papers to be read, he would only say, that on the first day of meeting it was found very difficult to arrange matter for the Section, as, although notices of abundance of communications had been received by the secretaries, yet few of these communications had been received, and in the difficulty of obtaining a knowledge of the residences of members at this early period, it was almost impossible to know how to communicate with the several contributors. He considered that part of the proceedings of the Sections to be most valuable and important, which gave the members present the opportunity, after a report or communication had been read, of asking questions to elucidate doubts or difficulties which might occur on the hearing of the communication itself, or of adding to the information it contained; confirming the views maintained in it, or even of controverting its statements of facts, or its conclusions. In exercising this privilege, however, the members would do well to remember the very limited time necessarily appropriated to these meetings, and the vast quantity of business to be disposed of, and to endeavour, as much as possible, to condense their remarks, and to confine them as closely as possible to the subject then under consideration. As, however, occasions might occur—and, indeed, had occurred—in which the knowledge of individual members regarding the length of time absolutely requisite for getting through the day's proceedings must be less exact than that of the officers of the Section, a power was very properly lodged with the President of putting a period to those most interesting conversations, and even, if necessary, of doing so to the interruption of a speaker while in actual progress: and he trusted, that

should such an occasion arrive, no member to whom this might happen would feel any personal annoyance, but would consider it as a matter of mutual arrangement, for the accommodation of all. He now called on the Secretary to read such reports from sub-committees appointed at the last meeting, as had been received.

Prof. Stevelly (one of the Secretaries) then read the following reports:—

1. Mr. Baily reported that the Committee appointed to represent to Government the importance of reducing the Greenwich Observations on the Moon, had waited on the Chancellor of the Exchequer, and that the sum of 2,000*l.* had been appropriated for that purpose, which was placed at the disposal of the Astronomer Royal, who had undertaken to superintend the reductions.

2. That the Reduction of the Stars, intended to form the enlarged catalogue of the Royal Astronomical Society, was in progress: that a small portion only of the original sum appropriated had been expended, but that, in all probability, the whole would be required in the course of the ensuing year.

3. That the reduction of the Stars in the *Histoire Céleste*, &c. was now in progress: that a small portion only of the sum appropriated had been expended, but that the whole amount would be required. Mr. Baily added, that he had made repeated application to the Secretary of the *Bureau des Longitudes*, for the corrected copy of the *Histoire Céleste*, gratuitously offered by that Board for the use of the competitors, but that he had not yet received any answer to these applications.

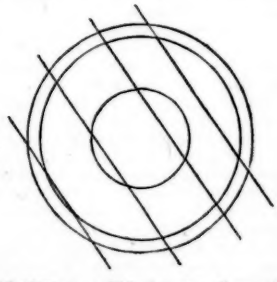
4. Report of Sub-committee appointed to arrange the establishment of an Observatory at Liverpool.

The Committee, after carefully examining the local circumstances of the port of Liverpool, and arranging the plan which seemed most expedient for the establishment of an observatory at Liverpool, laid it before the local authorities, who approved of the proposed arrangement, and expressed their readiness to carry it into effect, as soon as the necessary power could be obtained from Parliament.

(Signed) T. R. Robinson.

Lieut.-Col. Reid, R.E., then read 'A Report explaining the Progress made towards developing the Law of Storms, and a Statement of what seems desirable should be further done to advance our knowledge of the subject.'

Col. Reid commenced by stating that he had long been convinced that the operations of the Deity in the workings of his providential care over his creatures, were governed by fixed laws, designed by incomprehensible wisdom, arranged by supreme power, and tending to the most benevolent ends. That, however irregular the tempest or the tornado might appear to the inobservant, yet our own day had seen some of these phenomena reduced to rule; and he doubted not soon to convince the Section that we were on the eve of advancing some steps farther towards this most desirable end. He felt confident, indeed, that the laws of atmospheric changes were dependent on such fixed principles, that nothing was wanting but a more intimate acquaintance with the subject, to render man's knowledge of these laws as perfect as that which he had attained in any of the sciences now called strict. His attention had been first directed to the subject in 1831. He arrived, on military service, at Barbadoes, immediately after the desolating hurricane of that year, which, in the short space of seven hours, destroyed 1477 persons on that island alone. He had been for two years and a half daily employed as an engineer officer amidst the ruined buildings, and was thus naturally led to the consideration of the phenomena of hurricanes. The first explanation which to him seemed reasonable, he found in a pamphlet by W. C. Redfield, of New York, extracted from the American Journal of Science, a work much less known in this country than its value and great merits deserved. The north-east storms on the coast of America had attracted the attention of Franklin. He had been prevented, by one of these storms, from observing an eclipse of the moon at Philadelphia, which he was soon after astonished to find had been seen at Boston, although that town lay to the north-east of Philadelphia. This was a circumstance not to be lost on such an inquiring mind as Franklin's: he ascertained, upon inquiry, that the same north-east storm had not reached Boston for some hours after it had blown at Philadelphia; and that, although the wind blew from the north-east, yet the progress of the entire storm was from the south-west. He died, however, before he had made any further progress in this investigation. Col. Capper, of the East India Company's service, after having studied meteorological subjects for twenty years, in the Madras territory, published a work, in 1801, upon winds and monsoons, giving brief statements of their fatal effects, from Orme's 'History of Hindustan.' In this work he states his belief that hurricanes will be found to be great whirlwinds; and says, "it would not perhaps be a matter of great difficulty to ascertain the situation of a ship in a whirlwind, by observing the strength and changes of the wind. If the changes are *sudden*, and the wind violent, in all probability the ship must be near the centre of the vortex of the whirlwind; whereas, if the wind blows a great length of time from the same point, and the changes are gradual, it may reasonably be supposed that the ship is near the extremity of it." In this conjecture respecting the nature of hurricanes, Col. Reid conceived Col. Capper to be decidedly right, and the conclusion he drew from it has stood the test of close examination. Mr. Redfield, following up the observation of Franklin, and though probably unacquainted with the views or opinions of Capper, ascertained that while the north-east storms were blowing on the shores of America, the wind was with equal violence blowing a south-west storm in the Atlantic. Tracking Franklin's storms from the southward, he found, throughout their course, that the wind on opposite sides of the shore over which the storm prevailed, blew in opposite directions, and that, in fact, the entire storm was a progressive whirlwind, and that all these whirlwinds revolved constantly in the same direction. In one of the numbers of the American Journal of Science, (for 1831,) Col. Reid found collected together many records of the same storms, and a chart, on a very small scale, showing the progress of one. Strongly impressed with the conviction that Mr. Redfield's views were correct, he determined to verify them by making charts on a large scale, and laying down on them the different reports of the directions of the wind at points given in the American Journal of Science; and the more exactly this was done, the nearer was the approximation to the tracks of a progressive whirlwind. He then exhibited to the Section a volume containing eight charts on a large scale, of which the first and second chart contained the result of this part of the examination; and he explained how the arrows showing the direction of the wind at the several stations were all on the right-hand side of the several circles flying from the south, while at the stations at the left-hand, or towards the east of the chart, they were all coming from the north. Col. Reid went on to explain, that as his object was not to establish or support any theory, but simply to arrange and record facts, he had only at present to give such a sketch of what had been done, as would turn the attention of abler men than himself to this investigation, and to impress upon commercial men the importance of carefully preserving the logs of their merchant ships: the practice was, he found, to return these logs to the brokers so soon as the vessel returned to her port, and after his accounts were balanced, they were considered as of no further value. He had published at length the details of his examination of this question. He had procured the actual log-books of ships, and had combined their information with what he could obtain on land, thus comparing simultaneous observations over extended tracts. On the eighth chart he pointed out eight ships in several positions in the same storm, the tracks of several crossing the path of the storm, and the wind, as reported by the ships, corroborated by the reports from the land. The observations of ships possess this great advantage for meteorological research, that merchant-ships' log-books report the weather every two hours, and ships of war have hourly observations always kept up. After tracing a variety of storms in north latitudes, and being impressed with the regularity with which they appear to pass to the North Pole, and always revolved in the same direction, viz.—opposite to the hands of a watch, or from the east round by the north, west, south, and east,—he was led to conclude, that, in accordance with the order of nature, storms in south latitudes would be found to revolve in a contrary direction to that which they take in the northern hemisphere. He earnestly sought for facts, to ascertain if this were really the case, and had obtained much information confirmatory of the truth of the conjecture, before he was aware that Mr. Redfield had formed the same conjecture, without, however, having traced any storms in south latitudes. The general phenomena of these storms will be understood, if the storm, as a great whirlwind, be represented by a circle, whose centre is made to progress along a curve, or part of a curve, which is, in most cases, of a form approaching the parabolic, the circles expanding as they advance from the point at which the storm begins to be felt, the rotatory motion in the northern hemisphere being in the contrary direction to that in which the hands of a watch go round; while, in the southern hemisphere, the rotation is in the same direction as that in which the hands of a watch revolve. He pointed out how his views were illustrated by the disastrous storm of 1809, experienced by the East India fleet, under the convoy of the *Culloden* line-of-battle ship, and the *Terpsichore* frigate, and four British men-of-war, which left the Cape of Good Hope about the same time, intending to cruise about the Mauritius. Some of these vessels scudded and ran in the storm for days; some, by lying to, got almost immediately out of it, while others, by taking a wrong direction, went into the heart of it, foundered, and were never heard of more: others, by sailing right across the calm space, met the same storm in different parts of its progress, and the wind blowing in opposite directions, and considered and spoke of it as two storms, which they encountered; while others, by cruising about within the bend of the curve, but, beyond the circle of the great whirl, escaped the storm altogether, which had been for days raging on all sides of them. This led him to draw the very important practical conclusion as to how a ship should act when she encountered a gale, so as to escape from it. By watching the mode of veering of the wind, the portion of a storm into which a ship is falling may be ascertained: if the ship be then so manœuvred as that the wind shall veer aft instead of ahead, and the vessel is made to come up, instead of being allowed to break off, she will run out of the storm altogether; but, if the contrary course be taken, either through chance or ignorance, she goes right into the whirl, and runs a great risk of being suddenly taken aback, but most assuredly will meet the opposite wind in passing out through the whirl. To accomplish her object, he showed, by a diagram, that it was necessary the ship should be laid on opposite tacks, on opposite sides of a storm, as may be understood by drawing a number of concentric circles to represent the whirl of the hurricane, and then different lines across these, to represent the course of ships entering into, or going through the storm; but, to attempt the full explanation of even this, would extend much beyond our limits.



Col. Reid illustrated his views by reference to various circumstances connected with the great hurricane of 1780, and the position of the several ships of Sir George Rodney's squadron, as also those of the East India convoys in the hurricanes of 1808 and 1809. He pointed out the effects of these storms on the barometer and sympiesometer, and the practical lessons to be derived from their indications. He highly eulogized the anemometers of Prof. Whewell and Mr. Follett Ossler (*Athenæum*, No. 516), and particularly dwelt upon the importance of having the latter instrument placed at various stations in the usual tracks of these great hurricanes, as a means of deciding several important questions connected with them.

He likewise pointed out the value of inducing the several maritime nations to establish registers at their light-houses, and mutually to communicate their observations, from which would result a fund of most valuable information, which would doubtless throw light on this, and on other collateral subjects. He pointed out the coincidences which existed between these revolving motions, and those which galvanism caused around the poles of magnets, alluding to experiments, intended to be instituted by Mr. Clarke on an 84 lb. shot; also, that where Major Sabine had found the magnetic intensity least, viz. at St. Helena, there were no violent storms; his line of least intensity appearing to be the true Pacific Ocean of the world. He showed that the phenomena of waterspouts were exactly the reverse of those of hurricanes—alluded to their electrical states, and explained the variable high winds of those latitudes by the huddling together of the branches of many hurricanes as their whirls expanded; while, at the same time, the meridians of the several planes become more closely compacted, as the planes approach the pole; and because the diameters of these circles, over which the whirl of the storm was spread, often extended from 1000 to 1800 miles, observations made in the meteorological stations in the British isles, however valuable for other purposes, would not, by themselves, suffice for throwing light on this question.

Prof. Bache, of Philadelphia, stated, that he rose from an impulse which, though present for the first time in the Section, the members would excuse him as an American for obeying—namely, of gratification at the very handsome manner in which Col. Reid had brought forward the theory of his countryman, Mr. Redfield, on hurricanes. Having added so much to the stock of authentic facts, which had been collected for the purpose of examining this theory, Col. Reid would have been perhaps excusable, had he made Mr. Redfield's name less prominent in the discussion; but, with the modesty which marked the true cultivator of science for its own sake, Col. Reid had preferred to bring out prominently the labours of Mr. Redfield. Having done this justice to one of his countrymen, Prof. Bache remarked, that he was sure Col. Reid would follow it up by an examination of a rival theory of storms, by Mr. Espy, of Philadelphia. In this theory, the wind was supposed to blow in all directions towards the centre of the storm, and a large collection of observations had been brought by Mr. Espey to form this point, especially those at his command from various quarters of the United States, as Chairman of the Committee of Meteorology of the American Philosophical Society and the Franklin Institute. This theory, Prof. Bache further remarked, was entirely in accordance with observations which he had made upon the track of a storm, popularly called a tornado, which had passed over a portion of the state of New Jersey, in June 1835. He had surveyed, by compass, different parts of this track, and found the objects thrown down by the storm directed, in certain points of the track towards a centre on the line of the track. He had found no evidence of a whirling motion at the surface of the ground, such as Col. Reid supposed might produce a waterspout when passing over the sea. He concluded, by again calling the attention of the Section and of Col. Reid to the papers of Mr. Espy, published in the American Philosophical Transactions, and in the journals of the Franklin Institute.—Professor Stevelly said, that this was a subject to which he had devoted some attention; and from a very early period, it appeared to him, that almost the only possible mode of examining those great atmospheric phenomena of the winds with any chance of arriving at a satisfactory result, was, by inducing government to afford facilities for examining the log-books of the Royal Navy, and collecting their information as to simultaneous currents of wind in geographical positions, which would thus be scattered very much over the surface of the globe. He had expressed this opinion to several friends on the Committee at the Edinburgh meeting in 1834; but, from all, he received nearly the same reply, that there was no individual prepared for undertaking such a laborious examination and reduction of the logs, and that without such an individual, and the appointment of a committee, it would be in vain to attempt to induce the Admiralty to give access to these mines of information. It now appeared, that, at that very time, Col. Reid was actually engaged in a partial accomplishment of this task, with a limited object. He could not but congratulate him and the Section on the manner in which he had commenced this difficult and important field of research. One remark he was particularly glad to hear from Col. Reid, that he intended to advance no theory, but simply to record facts: he would venture to caution persons against being led away by any sudden suggestions, arising from superficial resemblances between the phenomena of atmospheric currents and those revolutions which electro-magnetic influences were now so forcibly urging on our attention. It was a wise saying of Bacon, that these idols of the human mind, even after they had been detected and dragged to light, were still apt to recur, and to produce the same injurious effects upon science under other disguises. He then stated, that he had, in the year 1834, at the Edinburgh meeting, attempted to explain, on well-established physical principles, four of the leading atmospheric changes of which winds, in most of their very various forms, constituted one: this mode appeared to him to afford a satisfactory reason for the phenomena of hurricanes, as detailed by Col. Reid; and, as the same explanation extended to the well-known progress of violent thunder storms in a direction opposed to the general course of the wind, he would briefly give it. When, from any cause, vapour changed from the elastic state to that of cloud, a partial vacuum was the consequence of the diminished tension: this caused a current in all directions towards that spot; as the air rushing in, if loaded with elastic vapour, could no longer retain it, more cloud was formed, a new partial vacuum produced, and, of course this process would be continued as long as the air containing the proper proportion of water came in; and the progress of this would be along the course where air, so loaded with vapour, was to be found, and, consequently, would begin, on great occasions, near the equatorial parts of the earth, and progress towards the poles. Now, just on the principle of water running out of a hole in the bottom of a vessel acquiring a rotatory motion, so would this air, in constantly rushing into the progressing partial void as it was formed: then as soon as causes came into operation for the falling of rain, the descending body of water would rush out before it, the air lying below, which would have to get out on all sides against the resisting air beyond, and would therefore turn into and increase the whirl, while the space left void of water above would still farther diminish the tension, increase the secondary formation of cloud, and all other physical consequences of a mixed atmosphere rushing into a partial void. Mr. Stevelly stated, that he was aware from information obtained from Prof. Bache, that the theory of Mr. Espy, of Philadelphia, was diametrically opposed to his view; and as it was based upon a violently ascending column, caused by the latent heat developed by the transition of vapour from the elastic state to that of water, it of course would also account for the whirl explained by Colonel Reid. In conclusion, he begged to call Colonel Reid's attention to a curious passage in Kotzebue's voyage round the world, in which in his voyage from New Archangel to California, when in lat. 40° he met with two violent contending winds, blowing from directly opposite quarters, and yet leaving between them a path some fathoms broad, stretching from east to west, and perfectly calm, while on both sides the winds and waves were in furious turmoil; these might, on Colonel Reid's principle, be opposite sides of two great simultaneous hurricanes, which happened to come near but not meet.—Dr. Robinson expressed the gratification he had received, while hearing Colonel Reid's valuable communication, and begged leave to ask Colonel Reid, whether he had any data by which he had been able to estimate the velocities of the progressive motions of these hurricanes, relatively to their revolving rapidity.—Colonel Reid replied, that the progressive motion varied from seven miles to twenty miles per hour, while the rotatory motion, being that of the true hurricane, was from 60 to 70, and even 100 miles per hour, according to its violence. These positions he illustrated by a reference to the progress of the ships of war, in the storm encountered in 1780, by Sir G. Rodney, as also by the several ships of the convoy of the *Culloden*.—Sir J. W. Herschel having resigned the chair to Mr. Baily, one of the vice-presidents, addressed the Section, and hailed this communication of Colonel Reid as one of happy omen for the progress of science in this important branch; and congratulated the meeting, that the subject had fallen into hands in which it was likely to receive so complete a sifting, and of those which had already made such progress in its elucidation. He did not rise at present to add anything to the stock of information already given, but, as having received from Mr. Redfield his papers on this subject, he could not neglect the opportunity of publicly expressing his thanks, and of stating the great pleasure he had derived from their perusal. And here he found an anecdote of Franklin frequently pressed on his recollection. A blunt sea-faring person had demanded from Franklin, or in his presence, what had been done for the advantage or security of sailors by any landsman? At least, replied Franklin, you must admit that a landsman had discovered that most useful art of *navigation*. It was not only at sea that the practical value of this splendid discovery respecting hurricanes would develope itself in enabling the sailor to escape its violence, instead of running ignorantly into the very jaws of destruction, by attempting to run away: but even on land it would suggest invaluable hints for the securing of life and property. One or two circumstances connected with Colonel Reid's charts, particularly impressed him: the first was the curious parabolic shape of the curves denoting the progress of these storms, so well calculated to give unfailing directions as to the nature and course of a storm, when accidentally encountered at sea; as the sailor had only to consider the parts of these curves in which he was placed, and the veering of the wind, and he had almost placed before him a chart of the hurricane. He next threw out the suggestion for Colonel Reid's consideration, whether the Gulf Stream would not perhaps give a clue to the direction of these curves, as so large a body of comparatively warm water must most materially tend to heat the air above it, and thus occasion disturbances of atmospheric equilibrium. Colonel Reid had stated, that he had no theory: in this no doubt he was judicious as an observer; but as, in the present assembly, a theory, if it served no better purpose, helped memory, suggested views, and was even useful by affording matter for controversy, which might produce brilliant results, by the very collision of intellect. In the second place, he remarked, that in the southern hemisphere the oscillations of the barometer, which were in an opposite direction to those of the northern, afforded a strong confirmation of the correctness of Colonel Reid's views. These revolving hurricanes reminded him, that on discharging a great gun unshotted, the mouth of which had been previously greased, a beautiful ring of smoke is formed, which passes to a considerable distance with much permanence, but enlarging constantly in diameter: upon attending closely to this, every part of the ring will be found to be in rapid revolving motion, thus exhibiting to the eye a hurricane in miniature, performing its evolutions. As to Mr. Espy's theory, though he considered it ingenious, yet he did not see how it was tenable against the indications of the barometer; for unquestionably, if a large body of air were to set on every side inwards, towards a central ascending column, the necessary effect would be an increase of weight of the entire barometric column: but there was even stronger evidence against it, for if the air acquired anything of a gyratory motion on the principle of the conservation of the *vis viva*, the rapidity of gyrations should increase enormously as we approach the centre of the column; just as we see the opera dancers, in the pirouette, increase the rapidity of the evolution as they diminish the circuit; and so we find in the indications of the facts detailed by Colonel Reid, regarding the hurricane, as the circles of its gyrations open and extend, the storm is progressing towards spending its fury and disappearing. Although it did not bear directly on the question now under discussion, yet he could not help saying, that there are circumstances connected with the spots on the sun, which forcibly impressed his mind with the idea of tornadoes in the solar atmosphere, which, by scattering and opening out the luminous superficial matters, laid bare the opaque and dark mass beneath. It had at all times been a question with astronomers, how the spots were formed, supposing the luminous matter of the sun to be a merely superficial and uniformly spread stratum: but something like violent

hurricanes being supposed to take place in the solar atmosphere, the difficulty was much diminished, if it did not entirely disappear; and in truth the appearance of the spots within the last year or two, was such as farther to induce the supposition of something in the solar atmosphere very like our trade-winds, for whereas, most usually, the spots have been scattered not very regularly over each hemisphere, they have latterly appeared more in lines following each other in succession, and having apparently an inclination towards the sun's equator on each side. If decided indications of anything like trade-winds should, by this or other circumstances connected with the spots, be detected, the other conclusion would be much strengthened.

The Vice-President then called on Sir J. Herschel for a communication of his reduced observations on stars and nebulæ, at the Cape of Good Hope.

Sir John Herschel said, that the notice, it was his his intention to lay before the Section reduced itself to three heads.

1. 'Reduced Observations of 1232 Nebulæ and clusters of Stars, made in the years 1834, 5, 6, 7, 8, at the Cape of Good Hope, with the 20-feet Reflector,' by Sir J. Herschel.

2. 'Reduced Observations of 1192 Double Stars of the Southern Hemisphere,' made as above.

3. 'Micrometrical Measures of 407 principal Double Stars of the Southern Hemisphere, made at the Cape of Good Hope, with a 7-feet Achromatic Equatorial Telescope,' by the same.

'A List of the Approximate Places of 15 Planetary and Annular Nebulæ of the Southern Hemisphere, discovered with the 20-feet Reflector,' by the same.

'Drawings illustrative of the Appearance and Structure of 3 principal Nebulæ in the Southern Hemisphere.'

The observations in the two first of these communications form parts of two catalogues of southern nebulæ and double stars respectively, which comprehend the chief results of his astronomical observations at the Cape. They are complete only as far as the first nine hours in right ascension. In the other hours, only a few of the objects which occur are added, being the results of a partial and very incomplete reduction of the observations in those hours. Sir John considered it probable, that when the whole reductions of his observations shall enable him to complete these catalogues, the total number of objects contained in them will be nearly doubled. The first catalogue contains all the nebulæ and clusters comprised in the two Magellanic clouds, which are very numerous. Each reduced observation expresses the mean right ascension, and north polar distance of the object for the beginning of 1830, together with a description (in abbreviated language) more or less detailed, of its appearance and physical peculiarities —as to size, degree of brightness, condensation, &c. The observations of double stars in the second catalogue, express the mean place for the epoch above named—the angle of position of the stars with the meridian, as micrometrically measured at the time of observation—the estimated distance, and the magnitude assigned to each star, together with a column of remarks, in which peculiarities of colour or other phenomena are noted. The micrometrical measures in the third paper, were taken with the same achromatic and micrometer, and are arranged in precisely the same manner as the former similar observations made by the author, which have been printed in the Transactions of the Astronomical Society. Among the principal double stars in this work occur, α Centauri, α Crucis, γ Centauri, γ Lupi, μ Lupi, π Lupi, β Hydræ, ε Chameleontis, γ Piscis Volantis, γ Coronæ Australis, &c. Of these, the measures therein stated afford unequivocal evidence of rotation in several of the double stars, among which may be particularized α Centauri, β Hydræ, γ Coronæ, and π Lupi. In the case of α Centauri, the diminution of distance, even within the comparatively short period of observation, is remarkable; and the author stated verbally, that on examining the catalogues of the Astronomical Society, and that of Captain Johnston, and the Paramatta Catalogue, in all which the places of the two stars are given separately, he finds this diminution of distance fully borne out, and regularly progressive; from which he is led to conclude, that in no great number of years from the present time (15 or 20), the stars may be expected to appear in contact, or to be actually occulted one by the other, as has recently been observed to happen to γ Virginis. The fourth of these communications is a list of the planetary and annular nebulæ of the Southern Hemisphere, which have been detected by Sir J. Herschel in his sweeps. They are arranged in order of R.A., and numbered. Among these, several are somewhat elongated, and offer the appearance of being double. One of them (No. 7) is of a fine blue colour, and being particularly well defined, has exactly the aspect of a blue planet. No. 4 is a very bright and considerably large ecliptic disc of uniform light, on which, but excentric, is placed a pretty large star. Several are very small; No. 15, in particular, is not more than 3″ or 4″ in diameter. Many of them occur in crowded parts of the milky way, with not fewer than 80 or 100 stars in the field of view at the same time.—The drawings above mentioned are copies of much more elaborate originals, and are produced to the Section merely as specimens selected from a greater collection, illustrative of three of the most singularly constituted nebulæ in the Southern Hemisphere, viz. θ Orionis, η Argûs, and 30 Doradûs. While waiting for his drawings, which had been sent for, Sir John gave several examples from the voluminous tables of the manner of registering the observations respecting each star, double star, nebulæ clusters, and nebulæ, comparing some of them to swarms of bees when settling; he also explained how, by the contrivance of a small achromatic collimator placed inside his great sweeping telescope, he was able to obtain nearly the same precision in his observations, as was to be had in fixed observations; although, from the ropes and wooden frame with which it was mounted, it was subjected to great hygrometric and pyrometric changes of form and position. These changes, however, by equally affecting the cross of the collimator, as the object itself, were readily detected and corrected.

Dr. Robinson begged to ask some questions, prefacing them with a remark suggested by what Sir J. Herschel had said of the defective means by which the places of his catalogue were determined. The forty-foot telescope of his illustrious father had been so often described, that it was a sufficient description of the instrument used at the Cape, to say, that it was of similar construction. This certainly seemed to present a great contrast to the steadiness of fixed instruments. But the fact was, that instead of the accuracy of Sir J. Herschel's places being merely sufficient to find the objects, it was in his other catalogues much more considerable, surpassing even that which forty or fifty years since was obtained in many stationary observatories. In what had been said of the application of reflecting telescopes to divided instruments, he fully concurred, as, notwithstanding the great increase of the size of achromatics in later years, it seemed improbable that they would ever reach a size which could not be easily over-matched by reflection. Something to this effect had been done in Ireland. His own observatory possessed a reflector of 15 inches aperture, applied to an equatorial of cast iron, which gave polar distances with a probable error of about 6 seconds, and right ascensions to the ultimate reading of the hour circle verniers. The artist who executed this, had since made a reflecting transit of six apertures, which performed well, and its collimator was not affected by reversion. In fact, it was as steady as those of the ordinary construction. In the unique double star α Centauri, he wished to know whether, during Sir J. Herschel's residence at the Cape, its orbital motion had sensibly changed. (A reference to catalogue showed that both the angle of position and the distance had varied.) Was he disposed to consider the many large stars with small close companions, noted by him optically or physically, double? Were any stars, but the six previously known, in the trapezium of Orion's nebulæ, seen by him?—Sir J. Herschel had found none *there*, but several were laid down in the neighbourhood of it, which had been laid down by Mr. Cooper or Mr. Lamont, who observed at Munich with a refractor of 10¼ inches aperture.—And lastly, whether he had obtained any measures of planetary nebulæ and stars in their vicinity, which might serve to indicate any motion in those singular objects?—Sir J. Herschel had several such, which, however, were extremely difficult, but had not yet perceived any change. Indeed, the only change in a nebula which he had yet noticed, was in that of Orion. A small tranverse strip, which, when he first figured that nebula, was straight, had become curved, and showed a knotty appearance, which certainly it did not possess before.

Section B.—CHEMISTRY AND MINERALOGY.

President—Rev. W. Whewell.
Vice Presidents—Dr. T. Thomson, Dr. Daubeny, Prof. Graham.
Secretaries—Prof. Miller, Mr. H. L. Pattinson, Mr. Thomas Richardson.
Committee—Prof. Johnston, Dr. Clanny, Dr. R. D. Thomson, Messrs. H. H. Watson, W. West, F. Zoeppritz (Darmstadt), T. Thomson, Coathupe, Dr. Gregory, Dr. G. Bird, Mr. R. Addams, Dr. Andrews, Messrs. R. Mallet, Warington, Lowe, Dr. Reid, Mr. Ch. Tennent, Thos. Exley, M.A., Dr. Rees.

The following papers were read:—

'On Natin's Diarseniate of Lead,' by Thomas Thomson, M.D., Professor of Chemistry, Glasgow.

During the meeting of the Scientific Association in Liverpool, a mineral-dealer from Cumberland exposed a collection of minerals from Alston Moor for sale. Among the rest, was one labelled "Vanadiate of lead, from Caldbeck Fell." It was in botryoidal concretions upon quartz. Several of these nodules, under the microscope, had the aspect of cylinders. Colour, honey yellow, like that of arseniate of lead, but lighter, and much less translucent. Lustre resinous, and more brilliant than that of vanadiate of lead. Does not scratch calcareous spar, but scratches gypsum with great facility. Specific gravity, 7.272; that of vanadiate of lead is only 6.663. Before the blow-pipe on platinum foil, melts into a transparent globule, which assumes nearly its original appearance on cooling. On charcoal, it gives out abundance of arsenical fumes, and leaves globules of metallic lead. It was twice analyzed (said Dr. T.) in my laboratory by Mr. Stenhouse, and found to be composed of—

Chlorine	2.46
Lead	7.10
Arsenic acid	18.20
Protoxide of lead	70.14
Peroxide of iron	1.20
Volatile matter	1.00
	100.1

Abstracting the chloride of lead and oxide of iron, we have two atoms of oxide of lead united to one atom of arsenic acid. It is therefore a *diarseniate of lead*, a species new to mineralogy.

'Observations on the Constitution of the Commercial Carbonate of Ammonia,' by M. Scanlan.

Having occasion (said Mr. S.) some months ago to make a quantity of the "Solution of Sesquicarbonate of Ammonia," of the London Pharmacopœia, instead of adding, at once, the entire quantity of water necessary for the solution of the salt, I took a large jar of the commercial carbonate of ammonia, just as it is furnished by the manufacturers, in lumps, and poured upon it barely as much cold distilled water as was sufficient to cover the salt, expecting, of course, to obtain thus a saturated solution. When the solution was completely a saturated one (sp. gr. 1.150), it was decanted, and the undissolved salt covered with fresh distilled water. This, also, was suffered to stand until it ceased to increase in specific gravity; but I was surprised to find the gravity much less than that of the first solution. Successive portions of distilled water were added, as before, till the solution of the whole of the salt was effected; and it was found, that solutions constantly decreasing in gravity, and smelling less of ammonia in proportion as the specific gravity decreased, were obtained. I satisfied myself that each solution was a saturated one, by decanting it, taking its specific gravity, and returning it upon the undissolved salt, until it ceased to acquire additional specific gravity, allowing for temperature. It was obvious from this, that the commercial salt operated upon, either originally consisted of two distinct salts, separable from one another by virtue of their different rates of solubility, or that the water decomposed and resolved it into two distinct carbonates of ammonia. My last solutions had scarcely any smell of ammonia, and afforded, on reduction of temperature, regular crystals of bicarbonate of ammonia. The first solution, of sp. gr. 1.150, also afforded crystals on reduction of temperature, which, when dried on bibulous paper, smell powerfully of ammonia, and are, no doubt, the carbonate: these effloresce readily; the bicarbonate does not. I was not aware, until apprised by Mr. Richard Phillips, that Dalton had noticed this action

of water on the commercial carbonate of ammonia long ago. In vol. 3 of the Manchester Memoirs, will be found a paper by Dalton, put into my hands by Mr. R. Phillips, in which he notices the loss of weight and smell of the commercial carbonate of ammonia by exposure to air; and he proves there, that the salt which remains is constant in its composition, including always the same proportions of carbonic acid and waters: this he calls the carbonate, the other the subcarbonate. Dr. Dalton, in a letter dated the 3rd of March last, refers me to this printed paper, in which there is no mention of the action of water, noticed above by me; but he gives me, in his letter, some additional facts from his notes in 1813, from which it appears he had observed precisely the same thing I did. He says, "I took abundance of salt—that is, what is commonly called carbonate of ammonia—first poured (the same as you do) a small quantity of water on the salt, then tried its specific gravity, which was 1.114; a second solution was 1.106, a third, 1.093, and, each diminishing, the last (seventh) was 1.043, when it was all dissolved. A like sample, dissolved altogether, had sp. gr. 1.086." Dr. Dalton then goes on to say, "It was evident from this, you will see, that there was a mixture of two salts. I take it there is no sesquicarbonate, nor other *sesqui* at all." It would appear, then, from the facts observed by Dalton, and more lately by myself, without any knowledge of his experiments, that the commercial carbonate of ammonia is not a homogeneous salt, a true sesquicarbonate, as Mr. Phillips looks upon it to be, but a mechanical mixture of carbonate and bicarbonate—for, as I have already observed, the water must act in one of two ways—either it simply separates the carbonate, being the more soluble, from the bicarbonate, which is the less soluble salt, or it decomposes the sesquicarbonate (if such it be), in the same way that a crystal of nitrate of bismuth is decomposed by water. Now, if this latter were the case, the masses of the commercial salt, operated upon as I have described, would have been disintegrated—they must have been broken down to powder. But, upon experiment, this is found not to be the case. The irregular masses of salt still retain, almost exactly, their original form and dimensions—they are, in point of fact, skeletons of the original mass, but consisting solely of a congeries of crystals of bicarbonate of ammonia, from the interstices of which carbonate of ammonia has been removed by the solvent power of the water, if we do not proceed so far as to dissolve all. What takes place here, may be likened, in some measure, to bone from which the gelatine is removed by water, leaving the phosphate of lime. Independently of showing the true nature of the salt, this is of some importance, as it affords us a very ready mode of preparing bicarbonate of ammonia without waste, such as occurs by exposure of the commercial salt in powder to the air, or without the trouble of transmitting a current of carbonic acid gas through its solution, as directed by the Dublin Pharmacopœia: indeed, the latter method is both troublesome and wasteful, for it is difficult to evaporate a solution of bicarbonate of ammonia without decomposition. I have found that water at 90° or 100° decomposes bicarbonate of ammonia, setting carbonic acid at liberty.

'On the Blackening of Nitrate of Silver by Light,' also by Mr. Scanlan.

Nitrate of silver was recommended many years ago, as well as I remember, by Dr. John Davy, as a test of the presence of organic matter in distilled waters. He showed, that if nitrate of silver in solution be added to perfectly pure water, it is not altered by exposure to direct sunshine; but if the water contain a trace of organic matter, it will become blackened. It would seem to follow, as a matter of course, from this, that solid nitrate of silver is not blackened by exposure to light, (although the contrary is stated in almost every work on chemistry,) unless it be in contact with organic matter; and this we find to be the case by experiment. Mr. Fergusson, some years ago, when he had the management of the chemical laboratory belonging to the Dublin Apothecaries Company, first showed me, that perfectly pure nitrate of silver is not blackened by long exposure to direct sunlight, but I believe he never gave further publicity to this fact, than mentioning it to his chemical friends in Dublin at the time. In consequence of some observations upon the blackening of this salt, made by Dr. Aldridge, of Dublin, in his review of Mr. Phillips's translation of the London Pharmacopœia, I was led to make the following experiment upon the subject:—I took two cylinders of perfectly pure fused nitrate of silver, immediately they were cast, from the mould, and wrapped one of them in paper, in the usual way that it is found in the shops; the other cylinder was transferred to a glass tube, and sealed up hermetically, by means of the blow-pipe, without being suffered to come in contact with organic bodies: it was pushed from the mould into the tube by means of a glass rod. After a lapse of three days, the paper was removed from the first, and it was then sealed up in a tube, in a similar manner to the other. The two tubes were now exposed to the direct rays of the sun, and in half an hour the nitrate of silver that had lain in contact with paper was blackened, while that in the other tube was not altered by six weeks constant exposure. The whole amount of blackening of the cylinder that had been papered was produced in the half hour. Nitrate of silver, free from organized matter, is sometimes blackened, I find, by exposure to the air; but this may be owing to the presence, perhaps, of sulphuretted hydrogen, accidentally present. Atmospheric air too is, I believe, seldom free from organic matter, at least in London, as may be seen readily by looking through a sunbeam.

'Examination of Sphene,' by Thomas Richardson.

The author having been supplied with two specimens of Sphene by Mr. Hutton, of Newcastle, submitted them to analysis. One of these, from Arendahl, in Norway, possessed a specific gravity of 3.425;—colour, light brownish yellow;—translucent;—brittle;—fracture uneven;—lustre vitreous, inclining to resinous. The mineral was fused with carbonate of soda, and the fused mass digested in the cold with dilute muriatic acid. Caustic ammonia was added, and the precipitate separated by filtration. The precipitate was washed with cold distilled water, and in this state was exposed to the air for about six weeks without the application of heat, when it appeared quite dry. The solution and washings from the precipitate were carefully evaporated to dryness, but on digesting the same with water everything redissolved, showing that all the silica had been precipitated by the ammonia. The solution, after being gently heated, was mixed with oxalate of ammonia, and the precipitated salt of lime thrown on a filter. The dry precipitate obtained by ammonia was digested in the cold with concentrated muriatic acid, and the insoluble portion, after the ordinary washing and ignition, weighed. The titanic acid was precipitated from the filtered solution after being gently warmed by caustic ammonia, of which reagent an excess was carefully avoided. The specific gravity of the second specimen was 3.5128;—hardness, 6.75;—lustre, resinous;—colour, cinnamon brown;—cross fracture, granular and uneven;—opaque, but translucent in thin plates. Before the blowpipe, alone on charcoal, it became white, but did not fuse. With carbonate of soda in the oxidizing flame it fused into an orange bead. Its locality is not known. The following is the composition of the two specimens:—

Silica	31.05	29.35
Titanic Acid	43.90	42.60
Lime	24.80	24.90
Water	1.00	1.15
	100 75	98.00

and the formula,—

$$3\,(Ca\,O,\,2\,Ti\,O_2)+2\,(Ca\,O,\,2\,Si\,O_3).$$

'A Paper on the Specific Gravities of Nitrogen, Oxygen, Hydrogen, and Chlorine, and of the Vapours of Carbon, Sulphur, Arsenic, and Phosphorus,' by Thomas Exley.

After observing that each atom of common matter would attach to its sphere of repulsion an atmosphere of ethereal matter, equal, in the sum of the forces of its atoms, to the force of that to which they are attached; and that alternate spaces of stronger and weaker attraction would succeed each other from the centre outward; it was noticed that Dr. Thomson, by careful and repeated experiments, has ascertained the specific gravities of the following gases to be these:—viz. nitrogen $\frac{35}{30}$, oxygen $\frac{1.0}{9}$, hydrogen $\frac{1.0}{144}$, and chlorine $2\frac{1}{2}$; and by examining the experiments of the best chemists it will be found, that no numbers can be fixed on nearer the truth than these. Nitrogen is the most permanently gaseous, and seems to be the most elementary in its character; the experiments of chemists nearly agree as to its specific gravity as follows:—

.9691 Biot and Arago
.973 Thomson
.976 Berzelius and Dulong
.9705 Thenard.

The mean of the first three exceeds $\frac{35}{30}$ by only $\frac{1}{2000}$ of an unit, and the mean of all four falls short of it by the same very minute quantity. Two volumes nitrogen and one oxygen make two of protoxide of nitrogen, the specific gravity of which Berzelius found to be 1.5273; from this and the above we have for the specific gravity of oxygen,—

1.1164 Biot and Arago
1.1086 Thomson
1.1026 Berzelius and Dulong
1.1136 Thenard.

The first and last are a little more than $\frac{1.0}{9}$, and the two others a little less; the direct experiments of Dr. Thomson give 1.1117; these considerations afford sufficient evidence that $\frac{1.0}{9}$ is either exactly the true specific gravity of oxygen, or that it scarcely differs from it at all. The same appears from other considerations. All gases have a degree of cohesion, and, were it not for the pressure, would be held between their attractions and the pressure of ethereal matter in a state of equilibrium. Nitrogen forms the basis of the atmosphere, probably because of its large sphere of repulsion; its proportionate quantity to that of oxygen will depend on the balance of affinity between the two, and that of oxygen for terrestrial bodies, affected by the tendency of the one to be a submultiple of the other; because in this case the attachment is more equable on all sides the oxygen; and as we know that the nitrogen is very nearly four times the oxygen, it follows that that is the exact ratio, from which we obtain $\frac{1.0}{9}$ exactly for the specific gravity of oxygen; since it was shown that nitrogen is $\frac{35}{30}$. Ammonia in two volumes contains one of nitrogen and three of hydrogen; its specific gravity was found by experiment as follows:—.590164 Davy, .590331 Thomson, .5912 Berzelius. The specific gravity of hydrogen as derived from these separately is .069368, .069479, and .07003; in these the agreement is very remarkable, being extremely near to $\frac{1.0}{144}$; Davy's gives $\frac{8}{2\,3\,0\,0\,0}$ in defect, Thomson's $\frac{1}{2\,3\,0\,0\,0}$ in excess, and that of Berzelius $\frac{15}{2\,3\,0\,0\,0}$ in excess; but this last chemist finds the specific gravity of hydrogen to be .0689 less than $\frac{1.0}{144}$; the mean of his two experiments gives .06946, which exceeds $\frac{1.0}{144}$ by only $\frac{1}{3\,0\,0\,0\,0}$ of an unit, which agrees almost exactly with Dr. Thomson's direct experiment. Berzelius and Dulong found the specific gravity of oxygen and hydrogen to be as 16.014 to 1, which also is very nearly identical with the above. Also Gay-Lussac found the specific gravity of steam to be .6235, which gives for hydrogen .0692, which again scarcely differs from the above at all. Nothing can be more satisfactory to prove that the specific gravity of hydrogen is $\frac{1.0}{144}$. Muriatic acid consists of equal volumes of chlorine and hydrogen without condensation. Dr. Thomson found by experiment that the specific gravity of this gas is 1.2843, which gives for the specific gravity of chlorine 2.4992, and this differs from $2\frac{1}{2}$ by less than the $\frac{1}{3\,0\,0\,0}$ of an unit. By direct experiment, Dr. Thomson found the specific gravity of chlorine exactly $2\frac{1}{2}$; Sir H. Davy found that a cubic inch weighed between 76 and 77 grains: the mean gives 2.5081, the same as before. Carbon is of great importance, the specific gravity of its vapour cannot be found by direct experiment, but may be determined from its combinations. The specific gravity of cyanogen was found by Gay-Lussac to be 1.8064, and it consists of one atom or volume of nitrogen and one of carbon, condensed into one volume; this gives for the specific gravity of carbon vapour .8342. Again, the specific gravity of olefiant gas is .9709 by careful experiments made by Dr. Thomson; and this gives for carbon vapour .8321; both these differ less than the $\frac{1}{1\,0\,0\,0}$ of an unit from $\frac{1.0}{12}$, which is nearly the mean between them. The same may be

shown from carbonic acid, carbonic oxide, and other compounds. In a former paper I proved that 12 to 1 is much nearer the truth than $12\frac{1}{4}$ to 1 for the atomic weight or the specific gravity of carbon vapour. The accurate experiments of Dumas give the specific gravity of chloroform 4.2, and of chlorocyanic acid 2.153, and taking carbon $\frac{1.0}{12}$ and hydrogen $\frac{1.0}{144}$ the former gives 2.4991 and the latter 2.5005 for the specific gravity of chlorine; all but identical with the above determinations. The vapour of sulphur presents a remarkable peculiarity. The specific gravity of sulphuretted hydrogen was found by Gay-Lussac to be 1.1921, and by Thomson 1.1788; the former gives for the specific gravity of sulphur vapour 2.2436, and the latter 2.2188; both are nearly, and the mean very nearly $\frac{2.0}{9}$. The specific gravity of sulphurous acid is found by Davy 2.229, and by Thomson 2.221; both these also give very nearly $\frac{2.0}{9}$, which lies between them; from these we should conclude that the specific gravity of sulphur vapour is $\frac{2.0}{9}$, double that of oxygen. But the specific gravity of sulphur vapour is by the experiments of Dumas between 6.51 and 6.617, and by those of Mitscherlich 6.9; the mean is very nearly $\frac{6.0}{9}$, or three times $\frac{2.0}{9}$. But what if sulphur vapour consist of single groups of three atoms each? This would perfectly solve the difficulty; and is there in it anything objectionable, or contrary to analogy? Etherine consists of single groups of six atoms each, and camphene of thirteen atoms in a single group, and there are many other examples. This also follows from the fact that sulphur, after attaining by increased temperature its highest degree of liquidity, does, by increase of temperature, thicken till it becomes a soft solid; and again, at a still higher temperature, becomes again liquid, and is by farther heat converted into vapour. How can the thickening be but by the formation of the groups? Without this be admitted, the fact is unaccountable. And on this ground calculation gives $\frac{6.0}{9}$ for the specific gravity of sulphur vapour. This also gives a reason for the fact, that sulphur crystallizes in two incompatible forms. Calculation gives for the simple vapours of arsenic and phosphorus, the specific gravities $5\frac{1}{4}$ and $2\frac{2}{3}$; but the doubles of these, viz. $10\frac{1}{2}$ and $4\frac{4}{9}$, are very nearly the experimental results, showing that their vapours are in single groups of two atoms each; from this arises their remarkable isomorphism. Hence this rule for finding the specific gravity of all gaseous bodies, simple or compound,—viz., add together the atomic weights of the atoms composing a simple group, and multiply this sum by $\frac{1.0}{144}$, the result is the specific gravity required. When the gas is in double groups, half the sum of the weights of its atoms is the weight of a single group; and atoms united by cohesive combination may be treated as mixed gases. Thus we may be sure that the following numbers are the specific gravities of the substance examined, viz.,—$\frac{35}{36}$, $\frac{1.0}{9}$, $\frac{1.0}{144}$, $\frac{1.9}{4}$, $\frac{1.0}{12}$, $\frac{2.0}{9}$, $\frac{0.5}{16}$, and $\frac{2.0}{9}$, or, in decimals, N = .9722, O = 1.1111, H = .0694, Cl = 2.5, C = .8333, S = 2.2222, As = 5.2777, and P = 2.2222. The facts above stated show that no numbers nearer the truth than these can be fixed on; hence they become eight important constants, which, if received as such, will spread their influence through chemistry, and give to it an uniformity very desirable in chemical research and nomenclature: it will make the language of chemistry more universal and easy, on which account it would yield me pleasure if I could induce expert and experienced chemists, who are furnished with suitable apparatus, to experiment carefully on these substances, particularly on nitrogen gas, in order to confirm these results, or to correct them if requisite.—At the commencement of this paper, I asserted that no physical theory could be true, unless it admit a change of direction in the acting forces. This I demonstrated in respect of Mossotti's theory, (in the *Phil. Mag.* December, 1837,) and also in respect of Mr. Babbage's modification of it, where two sorts of atoms are supposed, each repelling its own particles according to some given law, and each attracting the other also according to some given law. Now this is but a particular case of the following general proposition. Let there be any number of sorts of matter, each repelling its own particles, and attracting each or any of the others, the forces being in each case governed by a given law; and proceeding from the centre outward, indefinitely, without change of direction in any of them; then, after the equilibrium is attained, there can be neither attraction nor repulsion on distant atoms. Admitting the new theory, it becomes a problem to ascertain the relative dimensions of the spheres of repulsion of the elements, as well as their atomic weights. The atoms of permanently gaseous bodies have large spheres of repulsion, especially if the atomic weights are small: thus hydrogen and nitrogen have large spheres of repulsion; and many reasons may be adduced to show that nitrogen has the greatest radius of repulsion of all the elements. The metals have very small spheres of repulsion, to which, probably, we may approximate from the atomic weights and specific gravities of the metals. Carbon seems to have the least sphere of repulsion of any known element: this follows from,—1st, its fixed nature, not being volatilized by the greatest heat; 2nd, its retaining the form it had in the vegetable; 3rd, its giving out a very great quantity of caloric when two pieces of fresh charcoal are suitably placed in the electric current; 4th, its great hardness and reflective power, after having given out the caloric; 5th, its giving out caloric while absorbing light, from which arises its blackness; 6th, its different bulk in the form of lamp-black, being twenty or thirty times greater than in common cases, when it is prepared after the best manner; with other reasons, particularly the great variety of compounds of carbon and hydrogen which occur, with the frequency of their being isomeric.—Mr. Exley concluded by suggesting an opinion, that there is another elementary body, not yet discovered, which has both an exceedingly small sphere of repulsion, and an exceedingly small atomic weight, or absolute force. This probably enters largely into the composition of animalcules, and especially their ova, which, settling into the lowest parts of the atomic atmospheres, are equally defended from heat and cold. This substance, he conceives, gives rise to the miasmata of marshes, to infectious effluvia, and other concomitant exhalations: chlorine, acids, and other substances, owe their disinfecting qualities to their power of absorbing this substance into their atmospheres. If its existence should be ascertained, *Microgen* might be deemed an appropriate name.

Section C.—Geology and Geography.

President for Geology—Mr. C. Lyell.
(For Geography) Lord Prudhoe.
Vice-Presidents for Geology—Rev. W. Buckland, D.D., Mr. J. Buddle, Mr. Richard Griffith.
Vice President for Geography—Capt. Sir George Back, R.N.
Secretaries for Geology—Mr. W. C. Trevelyan, Capt. Portlock, Mr. T. Jameson Torrie.
Secretary for Geography—Capt. Washington.
Committee—Wm. Smith, L.L.D., Viscount Cole, Sir Philip Grey Egerton, Bart., Mr. R. I. Murchison, *Gen. Secretary*; Rev. Prof. Sedgwick, Mr. G. B. Greenough, Count Breunner, Director of the Imperial Mines of Hungary, Marq. of Northampton, Mr. H. T. De la Beche, Prof. Phillips, *Assist. Gen. Secretary*; Messrs. Robert Ingham, H. Witham, Boscawen Ibbetson, J. B. Fryer, J. B. Jukes, James Bryce, Wm. Hutton, Richard Griffith, Jas. Smith, Chas. W. Hamilton, John Taylor, jun., Joseph Carne, Joshua Trimmer, Col. Silvertop, Major Jervis, R.I.C. Service, Capt. W. Allen, Capt. James Ross, Dr. Richardson.

The first communication brought forward, was 'A Description of a Bone Cavern in the Mendip Hills,' by Mr. Long.

The cavern is on the summit of one of the Mendip Hills, in a limestone rock. It was discovered in pursuing a fox, which fled there for shelter, and is entered by a perpendicular fissure, thirty feet deep. From a large chamber at the bottom of this fissure, an arched way leads into another chamber, from which a passage leads up towards the surface; and this latter seems to have been the original entrance. The bones are generally found imbedded in soft mud, in hollows in the bottom of the cavern, but sometimes also in stalactite. The greater part of the bones are those of the ox, horse, deer, fox, boar, &c. But the most interesting circumstance connected with this deposit is, the existence of human bones; they are found underneath the others. Nine skulls were also obtained. Many of the bones are in so decayed a state, that they crumbled to dust on being handled. It is worthy of remark, that none of the bones belong to extinct species.—Prof. Sedgwick observed, that no human bones had yet been found in any of the old caverns, unless under circumstances which clearly showed their recent introduction; and this cavern did not militate against the received theory of the formation of osseous breccias. It may have been a place of ancient sepulture, the bodies being let down through a stratum of clay and gravel.

Mr. Lyell referred to a curious case in the south of France. Human bones were found in a cavern associated with those of other animals, both recent and extinct, and also with pieces of pottery. To ascertain whether all these co-existed, tumuli were opened, and were found to contain, besides human bones and pottery, the bones of the ox and wild bull, the stag, and the wolf, which, though it does not now exist there, has existed till within a recent period; but no bones were obtained belonging to species now extinct in that country, as the rhinoceros, elephant, and hippopotamus. Hence it was inferred, that these latter did not co-exist with man in that region—that they were never hunted and destroyed by the aboriginal inhabitants.

The next communication was 'On the Newcastle Coal-field,' by Mr. John Buddle.

This coal-field occupies a tract in the counties of Northumberland and Durham, of about 700 square miles, the limits of which were accurately marked on a geological map of the district. Within this tract all the strata that compose the coal series may be traced continuously. The lowest bed in the series, that, namely, which lies next the millstone grit, is the Brockwell seam. There is, indeed, another seam of coal, called the eight-inch seam, at a perpendicular depth of $97\frac{1}{2}$ fathoms below the Brockwell seam, but separated from it by the entire mass of the millstone grit, and the upper bed of carboniferous limestone, and not, therefore, properly belonging to the series now under consideration. An account of this and the associated strata, the author reserved for another communication, as he wished to confine attention to the strata above the millstone grit. The surface of the country is finely diversified with hill and dale, presenting nowhere any elevation deserving the name of mountain, or any depression which can be called a ravine or glen. The hills decline gradually into the valleys, except on the east and south-east of the district, where the magnesian limestone fronts the west and north-west in steep escarpments, and at one place in the interior, where Sacriston Heugh forms an escarpment fronting the east. The valleys through which the Tyne, the Wear, the Derwent, and other rivers flow, have such an aggregate breadth, that on their excavation an enormous mass of the most valuable coal seams in the district have been destroyed. The valley of the Tyne from Hexham to Tynemouth, that of the Wear from Wilton Castle to Sunderland, make a complete section of all the seams lying above the millstone grit, as they cut through the several outcrops in their relative order of superposition. The vale of the Derwent also cuts through the entire series, with the exception of the highest, or Hebburn Fell seam. This complete exposure of the contents of the coal-field, is a compensation for the enormous waste before referred to; it has also caused the mineral wealth of this region to attract attention at an early period; and, in the infant state of mining, offered many advantages in the facility of working seams by horizontal adits, and effecting a cheap and easy drainage. Nay, even in the present improved state of this art, the valleys enable the miner to drain extensive collieries with ease, and facilitate the draining, by steam power, of the deeper mines. A range of hills of alluvial formation, consisting of sand and gravel, commences at Newburn, on the north side of the Tyne, and passes north and south, with some slight interruptions, by Stella, Beda Hills, Pelton Fell, and accross the Wear at Durham. The most curious exhibition of the ridge is at the Beda Hills, near Lintzford, on the Derwent. The thickness and breadth of the ridge are irregular; it does not extend so deep as any of the seams of coal, but has been very troublesome, in many instances where shafts were sunk in its line of direction. There are other detached masses of sand and gravel in various parts of the district. On the east and south-east side of the district, the coal strata plunge under the magnesian limestone series; but the depth to which they extend is unknown, and may be so for ever, as we are cut off, by the barrier of the German Ocean, from carrying our inquiries so far as to determine the eastern edge of the great trough or basin in which these strata have been deposited. There is, however, every probability that the Newcastle coal-field is really such a basin; for we find at South Shields the beds of coal rising towards the sea, and coal is raised at various places from under the magnesian limestone. A great many

seams of coal are found in this coal tract, but they differ much in different places; and seldom more than five of workable thickness co-exist; and often not more than one or two occur in the same locality. For example, in Monkwearmouth colliery there are thirty-one seams sunk through, in a depth of 264 fathoms, containing forty-seven feet of coal, inclusive of the interstratified foreign matters, but one seam only is worth working. The thickness of the seams varies from one inch to six feet. Also in Blackworth colliery, 283 beds have been bored through, in a depth of 206 fathoms, comprising forty-five beds of coal, which, with foreign interstratified substances, have an aggregate thickness of sixty feet; but of these only two or three are workable. These beds cannot, however, be regarded as continuous over the entire coal-field, as many of them can be traced to other seams, by whose splitting or division they have been formed. There are also some seams which have not been deposited in one locality as they have in others, distances of a mile or two often showing remarkable changes in the number and quality of the seams. The coal, generally speaking, is bituminous, but here also there is much variety. The strata consist of the usual alternations of argillaceous and sandy beds. The former, when soft, are called metal—when hard, metal stone. The sandstone beds are called Post. Argillaceous ironstone occurs interstratified with the metal stone. These various beds differ much in respect of texture, colour, &c., and it is difficult to identify them in remote localities. The best-defined sandstones near Newcastle are the grindstone, the seventy-fathom, and the main-post. The first supplies the Newcastle grindstones, which have been so long celebrated, and is extensively used for building: the two last lie below the grindstone, a great mass of argillaceous strata intervening. The main-post is the most continuous of all the strata in the district, and always accompanies the High Main coal seam; the other sandstone strata are not continuous over the district. The magnesian limestone in the east of the tract, overlies a large body of coal strata; but it is in an unconformable position, as is proved by many sinkings. The mouth of the Tyne may be regarded as the northern limit of the magnesian limestone, small detached portions only being found north of the river, in the promontory of Tynemouth, and again at Cullercoats. Here also the inferior new red sandstone is exposed to view. The strata of the coal-field are generally covered by a strong clay soil, particularly in the higher grounds; but in some places, a thick diluvium prevails, as from Byker to North Shields, where the band varies in breadth from one to two miles, and from a few feet to thirty fathoms in thickness. It consists of clay, sand, and gravel; the latter being generally underneath, upon the regular rock. Fragments of sandstone, mountain limestone, ironstone, basalt, greenstone, and granite, are found in the diluvium, more or less rounded by attrition. They have plainly been derived from older rocks lying westwards. The clay of this diluvium is finely laminated; and frequently between the laminæ there are arenaceous partings, in which crystals of selenite are found. Peat bogs occur in some places; alluvial deposits prevail in many of the valleys; and in the larger ones, peculiar lacustrine deposits, locally called washes, are frequent. One of these occurs near North Shields, but its extent is not well ascertained. It has denudated and destroyed the coal seams to an unknown depth, as they terminate on its western, and re-appear again on its eastern side. It has thus formed a great gap in the strata. A similar wash occurs in Ouseburn, and extends under the Tyne, and seems to be continued for some distance to the north-west, traces of it occurring at Jesmont colliery. Another extends from Chester-le-Street, thence to the bed of the Tyne, at Elswick colliery: its depth seems to be between thirty and sixty fathoms. The substances of which these washes are composed, are detritus from the neighbouring hills—clay, waterside sand, and gravel. In some places, where workings were carried on below this lacustrine deposit, an opening in the roof let down a current of sharp sand, in a completely unconsolidated state. Some of these deposits in the valley of the Tyne have been plainly formed in lakes, through which the river once flowed, but by the bursting of whose barriers a new channel was formed.

Prof. Phillips called the attention of the Section to the importance of the paper just read, and on the fact now placed beyond a doubt, that the true coal strata extended beneath the magnesian limestone series; he stated that some of the best coal taken to London was found beneath that deposit. He also remarked that the other coal-fields, both of England and Scotland, showed a perfect accordance with the Newcastle field in respect of the amount and thickness of the beds, the average total thickness of the coal seams being about 50 feet, including the interstratified matters, while the whole number of beds—283 to 260 fathoms—showed an average thickness of about 5 feet. He expressed surprise how any one could doubt the slow and long-continued deposit of the coal measures, when he saw exhibited before him such a vast mass of sand, clay, ironstone, and other substances, regularly stratified, and intermixed, in many places, with abundant remains of shells.—Prof. Sedgwick also expressed surprise that the extension of the coal strata under the magnesian limestone was ever doubted. He remarked on the general want of conformity of the magnesian limestone and coal series, though he stated there were some examples of complete conformability. The coal series passed insensibly into the lower portion of the new red sandstone system, but then the upper portion of that system was not conformable to the lower.—Mr. Murchison here put some questions to Prof. Phillips respecting the specific identity of the fossils, both animal and vegetable, of the coal, the magnesian limestone, and the strata intermediate.—In reply, the Professor pointed out the difficulty of identifying species of extinct fossils, while even in living nature, the characters which should define a species were not fixed. He noticed the great similarity, particularly as regards the lower animals, between the fossils of the magnesian limestone and those of the carboniferous limestone: some corals, especially reteporæ, seemed perfectly identical, while the same might almost be said of the productæ, spirifers, &c. The productæ have a wide range, from the lowest transition strata, to the inferior part of the new red sandstone. He stated that Mr. Miller had fallen into an error in identifying a species of crinoidea, from the magnesian limestone, with one from the carboniferous, the specimens on which he relied not having been from the latter rock. He concluded by urging the necessity of employing chemical and mechanical characters, as well as fossils, in classifying rocks, and by calling on Sir Philip Egerton for an answer to Mr. Murchison's question, so far as regarded the fossil fishes.—Sir P. Egerton stated, that so far as the discoveries of M. Agassiz had gone, the same species of fishes were not found in any two of the three formations under consideration. Some genera were, no doubt, the same; such as Palæoniscus, which was found in all the three.—Mr. De la Beche objected to the attempts to identify, to any great minuteness, strata which must have been formed under circumstances differing greatly at remote points. A series of sands and silts would vary with conditions, and would be necessarily local in their nature; and it would therefore be vain to expect to find similar repetitions in different parts of the world. It was on this account he objected to the term *coal measures*.

[It must be observed, that this Section includes both Geology and Geography. In consequence of Lord Prudhoe's absence, Sir George Back now took the chair.]

The next paper was entitled 'Recent Intelligence respecting the Frozen Ground in Siberia,' by Prof. von Baer, Imp. A.S., St. Petersburgh. Communicated by W. R. Hamilton, Esq., Pres. R. G. S. of London. In the absence of Mr. Hamilton, Capt. Washington, R.N., of the Geographical Secretary, read the paper, prefacing it by the following brief introduction:—It will probably be within the recollection of many members of the British Association, that in the spring of this year Prof. Baer, of St. Petersburgh, communicated a paper to the Royal Geographical Society on the subject of the ground ice of Siberia, which was followed up by a letter, on the same point, from Prof. Adolph Erman, of Berlin [*Athenæum*, Nos. 540 and 546], and in which the fact of frozen ground extending to the depth of nearly 400 feet at Yakutsk, is clearly established:—in continuation of Prof. Baer's paper, he has, within these few days had the kindness to communicate the most recent intelligence from that quarter, stating some farther opinions on the subject, and the measures taken by the Academy of Sciences at St. Petersburgh, thoroughly to investigate the fact.

The three great rivers which form the principal physical features of Asiatic Russia, flowing in a north direction, nearly parallel to each other, through 20° of lat., and all falling into the Polar Basin, are the Obi, the Yenisei and the Lena; the last of these, and the least in extent, has its source in the mountains which form the north-western shore of the lake Baikal, whence it flows in a north-easterly direction about 1000 miles, and then turns abruptly to the north for 600 miles, when it reaches the Arctic Sea. At its eastern angle, in lat. 62° north, long. 130° east, nearly, stands the town of Yakutzk, on the western bank of the river Lena, on an alluvial plain, surrounded by mountains, which inclose it at a distance of 10 or 12 miles. Its nearest distance to the Polar sea being about 600 miles, and to the sea of Okhotz about 400 geographical miles in a direct line. It was at this town that the above-mentioned well was opened. As my former communication (says M. Baer,) has been received with some interest, a similar interest will probably be felt in the measures adopted by the Academy, to ascertain precisely, not only the law which regulates the temperature of the ground to the depth which is affected by the periodical change of summer and winter, but also the influence of the external air in penetrating into the sides of the well or shaft at Yakutsk; and finally to ascertain the depth, which the summer heats (which are there very considerable with respect to its position,) generally reach. The experiments recommended for this purpose are, that two thermometers should be introduced, one a foot, the other six feet, into the side of the well at the several depths, 1, 3, 5, 10, 20, 50, 100, &c. to 350 feet, so that the difference between the two would show the effect of the air in the shaft on the temperature of the ground. The thermometers are to remain a whole year, and to be observed daily; a note is to be made of the depth at which the ground is thawed in autumn—whether in forest ground or under the dry steppes—in marshy countries, sandy places, &c. Attention is also to be paid to the greatest degree of heat reached by the ground in these several districts, at a foot and a half beneath the surface. These directions were sent to Yakutsk in February last, and if the means at their disposal will admit of it, they will also direct deeper excavations to be made, to pursue still farther the observations on the increase of temperature. It seems to me very important for physical geography, to ascertain the thickness of perpetually frozen ground in countries whose mean temperature is considerably below 0° R. I will merely mention one point: if, as is the case at Yakutsk, the ground never thaws at the depth of from three to four hundred feet, all the small streams whose superficial waters only are kept in a fluid state in the summer, must be in the winter entirely without water; and, *vice versâ*, we may conclude that all rivers which do not come far from the south, and whose course is entirely within those countries which preserve perpetual ground ice, and yet do not cease to flow in winter, must receive their waters from greater depths than those which remain in a frozen state. It is, then, clear that these veins of water penetrate the perpetual ground ice. This circumstance strikes me as one not devoid of interest in the theory of the formation of springs; and it would be very desirable that some researches upon this subject should be set on foot in high northern latitudes. In the narrative of Admiral Wrangel's Travels, still in MS., there occurs a remarkable instance of very considerable rivers in very cold countries being without water in winter, like our ditches and small brooks. He was riding, to the north of Yakutsk, in about 65° lat., over the ice of a large river, when the ice suddenly gave way, and his horse went under. He was himself saved by being thrown upon the ice at the moment his horse fell. He was lamenting the loss of his horse to the Yakutskis who accompanied him, as he knew not where to get another, when they laughed, and assured him they would soon get his horse back, and with a dry skin too! They got some poles and broke away the ice, under which the bed of the river was perfectly dry,

as well as the horse and his saddle. The Yakutskis were therefore aware that there was no water in the winter-time at the bottom of rivers of this size; and in this case the water must have disappeared before the ice had gained sufficient thickness to bear a loaded horse. Similar accidents, and similar results must doubtless have frequently occurred, during the many journeys which the English have made in North America; and the agents of the Hudson's Bay Company must be well acquainted with the real state of the small rivers in winter, in these high latitudes; *i. e.* whether all of them are in a fluid state below the ice or not. I am collecting materials to ascertain the *southern* limit of perpetual ground ice in the Old World; those I have are not yet very complete; but I am already aware that this phenomenon extends much farther in a southerly direction in Siberia than in Europe. The farther we go east, the more southerly we find the limit of perpetual ground ice. Humboldt found at Bogoslovsk, in lat. 59° 45′ N., at the eastern foot of the Ural Mountains, small pieces of ice at the depth of six feet in the summer; but this place is far north. No permanent ice has been found in Tobolsk in 58° N.; but at Beresow, in 64° N., where Erman found the temperature of the ground above +1° R. at the depth of 23 feet, we learn from the observations of M. Belowski, that the lower districts are never without ice in the ground, so that it is probable that Beresow is near the limit of perpetual ground ice. Further east, this frozen soil extends much more to the southward, even to the shores of the lake Baikal; indeed, the whole of the south-eastern angle of Siberia has perpetual ground ice. Captain Frehre states, that in 1836, he here found the ground frozen at some distance below the surface, and that this frozen stratum was continued uninterruptedly quite to underlying rock to the depth of from 10 to 40 feet. But as he always found rock there, it would be difficult to say how thick the layer of frozen mud would be in the lat. of 52°. It thawed on the surface of the banks of the river, to the depth of from 2½ to 6 feet, and from 6 to 9 feet on the naked heights; but, in the forests, where the rays of the sun were intercepted, the thaw reached only from ¾ to 1 foot deep. If it be true that there are places in forests where the ground is never thawed one foot deep, it would demonstrate how little is necessary for the ground to be thawed for trees to grow on it. The developement of the leaves and vegetation depends less on the temperature of the soil than on that of the air in the spring; it only requires that the ground should be so far thawed that the tree may be able to draw from it a sufficient quantity of moisture for its growth.

Mr. De la Beche remarked, that, considered geologically, this paper of Prof. Baer was an important one. It showed that the temperature of those regions had changed since the deposit of the detrital matter (for that was the character of the frozen ground), inasmuch as under the condition of perpetually frozen surface, no such deposits could take place. It was obvious that if a hole were dug in this country, and the air were kept constantly below the freezing point, all the water in the ground round the hole would be frozen; but such explanation would hardly answer in this case. He was anxious to be assured there was no equivoque in the observations.—The Rev. James Yates observed, that a fact of a similar kind, in a country much farther south, had been long ago published. He referred to crystals of ice permanently existing in a cavern in Auvergne. But this locality in France is comparatively cold from its elevation.—Captain Washington observed, As 6°R. is the mean surface temperature at Yakutsk, that according to the known law of increase of heat downwards, about 100 feet for each degree of Reaumur's scale, the freezing point would not be reached till 600 feet, and yet the frozen ground was here found to extend only 400 feet in depth, and therefore the surprise was rather that it had been found at so small, instead of at a greater depth; but it appeared to him, that the exact nature of the soil, and the height of Yakutsk above the sea, were important elements to enable us to arrive at a correct conclusion on this subject; these, doubtless, the Academy of Sciences will furnish us with; but should this country then refuse to follow up the observations to which we are invited in our possessions in North America? A vast field was offered for experiments, and there could not be a doubt, from the zeal and enterprise lately shown by the Hudson's Bay Company, that if recommended by the British Association, their wishes would be carried fully into effect.—Sir G. Back concurred in these remarks, and said, that in Messrs. Dease and Simpson's last enterprising journey along the Arctic shore of America, they had not found the ground thawed to a greater depth than one foot; and that, having a personal acquaintance with many members of the Hudson's Bay Company, he felt confident that the Association need but express its desires to have them fulfilled.

Section D.—Zoology and Botany.

President—Sir W. Jardine, Bart.
Vice Presidents—R. K. Greville, L.L.D., Rev. L. Jenyns, Rev. F. W. Hope.
Secretaries—Messrs. John Edward Gray, R. Owen, John Richardson, M.D.
Assistant Secretary—Prof. T. Rymer Jones.
Committee—Messrs. Joshua Alder, John Adamson, C. C. Babington, J. E. Bowman,—Bowman, W. Backhouse, Thomas Bell, Thomas Coulter, M.D., Messrs. J. H. Fryer, George T. Fox, Albany Hancock, W. C. Hewitson, Hon. T. H. Liddell, Mr. Edwin Lankester, Prof. Morren, of Liege, Patrick Neill, L.L.D. Mr. George Ord, (Philadelphia), R. Parnell, M.D., Mr. W. Robertson, Capt. James Ross, R.N., Messrs. P. J. Selby, W. Thompson, G. Wailes, T. Teale, W. C. Trevelyan, W. Yarrell, Richard Tayler, Rev. W. Hincks, Captain J. Cook, R.N., Messrs. J. Allis, Arthur Strickland, H. Watson, G. B. Sowerby, Prof. Ehrenberg, Joseph Woods, Prof. Graham, M.D.

The business of this Section commenced by the Secretary, Mr. J. E. Gray, reading a paper 'On a species of Fish having four eyes, found on the coast of Surinam,' by W. H. Clarke and John Mortimer. The attention of the writers was drawn to the subject of their paper, whilst on a visit at Parimaribo, the capital of the Dutch colony of Surinam, the sandy beach at Fort Amsterdam being annually visited by shoals of this four-eyed fish. The fish was described as being covered with scales pectinated on the posterior margin as in the Ctenoidean order of Agassiz, and as having the mouth armed by a coating of thick small hexangular teeth, bearing a resemblance to those of the fossil family of Pycnodonta, and well adapted for crushing the smaller crustacea, on which the fish was observed to feed. The ordinary length of the fish is three inches, and its colour is blackish green on the back, bright orange on the belly, with black and white streaks in the direction of the radii on the caudal fin. The organs of vision are four, the anterior pair resembling those of other fish in their position near the nostrils; the posterior pair being placed much farther back on the posterior face of a horny protuberance, or transverse crest, which rises from the top of the head, and, from its position, obstructs the line of vision backwards of the anterior eyes, or forwards of the posterior ones. Captain Spandermann, of the Dutch Marine, who assisted in these researches, pointed out the circumstance of the anterior eyes being always shut when the posterior ones are open, and the authors remark, that this fish differs from all others in its power of closing the eyes. They propose to institute the family of *Tessarophthalmoids*, for its reception. A pencil drawing of the fish was exhibited to the members of the Section.

The Rev. L. Jenyns thought, that if the paper could be authenticated, the communication was an important one. The occurrence of four eyes had never before, to his knowledge, been observed in any members of the vertebrate division of the animal kingdom.—The Rev. F. W. Hope stated, that, in invertebrate animals, especially the Insecta, it was not uncommon to meet with more than one pair of eyes; and, in some instances, the aggregated eyes of insects were divided into two compartments by a transverse membrane, which gave the appearance of two pairs of aggregated eyes. He thought the term Tessarophthalmoid should not be applied to this family, as the term, or an analogous one, was already used in the animal kingdom for a genus in Insecta.—Mr. J. E. Gray inquired, whether Mr. W. H. Clarke was present; as, from its nature, he feared, that either there were no grounds for the present communication, or that the statements had been made on the authority of others, and insufficiently examined. He thought the latter might be the case, and that reports might have been given of the above nature, from the existence of the Anableps, whose eyes are divided by a transverse membrane into two compartments.—Dr. Richardson agreed with Mr. Gray, and thought the present paper might be founded on misstatements with regard to the Anableps. Agassiz had a fish in his descriptions, very much like the present drawing; and by adding a hump, with two eyes at the back of its head, he thought the two would not then differ much. There were other suspicious circumstances about this paper. This fish was stated to have a great number of names, which were, in fact, common words, picked up by sailors in the various countries they visited, and Dr. Richardson explained many of the terms. The existence of four optic nerves was unknown amongst vertebrata, and the alternate opening and shutting of the eyes, seemed to him to be a motion unnecessary to aquatic animals.—The chairman, Sir W. Jardine, had seen so many anomalies in the kingdom of nature in his lifetime, that he was quite disposed to give the present paper consideration: at any rate, he should institute inquiries after Mr. Clarke, and the meeting would probably resume the subject.

Mr. Babington then read a paper 'On the Botany of the Channel Islands.'

In this communication the author mentioned the discovery of the following eight plants in these islands, in addition to those noticed at the Liverpool meeting, namely:—*Ranunculus ophioglossifolius*—*Orchis laxiflorg*—*Linaria pelisseriana*—*Myriophyllum alterniflorum*—*Polygala oxyptera*—*Ononis reclinata*—*Potamogeton plantagineus*—*Carex junctata.* He said that twenty species existed in the islands, which had not as yet been noticed in England, and Mr. Babington announced his intention of publishing an outline of this Flora.

Several gentlemen expressed their pleasure at the latter part of Mr. Babington's communication, as the work would form a link between the botany of Great Britain and that of the continent of Europe.

The Secretary then read a short description of a new British shell. He commenced by observing, that he thought it might be useful to some of the members of the Section, if he made a slight reference to the various collections of natural history which were scattered in abundance in the neighbourhood of their place of meeting. He recommended to the attention of the members the museum of the Natural History Society, for the liberality with which it was opened to the townspeople and visitors, stating that it was in this respect a rival to the national Museum itself; and indeed was even more available to all classes, as it opened its doors on certain evenings of the week, in order that the working classes might be able to attend. It was also interesting for the excellent, complete, and almost costly manner in which it was arranged; and additionally so to the more scientific visitor, on account of its containing several of the original specimens figured by Bewick, Brown, and Miller, thus affording a means of determining with accuracy the synonyms of those authors, which might be done with the assistance of the excellent catalogue of Mr. Fox. He pointed out the extensive collection of shells of Mr. Fryer, of Whitley, who first brought to this country many specimens from the Pacific coast of South America, which have since been caught in such abundance by Mr. Cuming and others, and the collection of the Rev. Mr. Mark, of Preston, from whence he hoped to bring several rarities before the end of the meeting. He mentioned the large collection of birds, shells, and other objects of interest, the property of Sir John Trevelyan, of Wallington, the basis of which collection was formerly the property of Lady Wilson, of Charlton, in Kent, and was constantly referred to by the writers of the last century; and pointed out the collections of Mr. Johnstone, so well known for his paper on British Zoology, which contains many interesting specimens of British and foreign animals, especially Mollusca and Radiata. He referred to the splendid conchological collection of Mr. Adamson, one of the local secretaries, and that of British shells in the possession of Mr. Alder. The collections also of Messrs. Hancock, consisting of shells and British birds, he mentioned as well deserving notice; and referred to an excellent collection of birds at Ravensworth Castle, in the possession of the Honourable Mr. Liddell. He lamented his inability to supply accurate information with regard to the botanical collections in the neighbourhood, but he would not pass unnoticed the collections of Mr. Bowman, of Newcastle, and of Dr. Johnstone, of Berwick. (Mr. Fox, of Durham, observed, that there was a museum in the University of Durham, deserving the attention of naturalists.) Mr. Gray then proceeded to describe the shell which had been discovered by Miss Isabella Mark, in the stomach of a haddock taken on the coast

of Northumberland, and which he believed had not hitherto been described, and proposed to make of it a new genus, which he would call *Neara*, and which would be peculiar for the slender produced form of the under edge, and the large size of the under lateral teeth. He stated, that he knew two species belonging to the same genus, one from China figured by Chemnitz, and called *Anatina rostrata*, by Lamarck, and the other from the Adriatic, described and figured by Olivier, under the name of *Tellina cuspidata*, and that he was not certain, without comparison, that the British species was distinct from the latter. He also exhibited a very splendid specimen of *Balanus scoticus*, attached to a species of Fusus, which had been obtained from the museum of Mr. Fryer.

Mr. Sowerby observed, that there was a representation of the shell Mr. Gray proposed to call *Neara*, in Cheek and Ainsworth's Geographical Journal, by Captain Brown. He said, that this shell abounded on the coast of Denmark. Mr. Alder, of Newcastle, stated, that Captain Brown informed him some time since, that he had described the above shell. Mr. Mark said, it was abundant in this neighbourhood.

The Rev. Mr. Wailes exhibited a specimen of the rare insect *Psalidognathus Friendii*.

Mr. Gray had seen a specimen of this insect in Mr. Children's museum. It had been found in the decomposed lignin of a decayed palm.—The Rev. F. W. Hope directed attention to the armature of the thorax of the insect, and stated that an insect of a similar kind would be figured in the next number of the Transactions of the Entomological Society. Mr. Charles Adamson was said to possess one of these insects, which was afterwards produced to the meeting, and found to be of a different sex from that exhibited by Mr. Wailes, the difference in the sexes being so great, that naturalists who had not seen the two, placed them in different genera.—Some further remarks then ensued on the nature of the movements of the Sawyer Beetle, which were asserted to be circular by Mr. Hewitson, who has in his possession specimens of this insect. He said that they injured apple-trees in this manner.—Mr. Sowerby doubted whether the perfect insect attacked the apple-tree; but Mr. Gray stated, that it was common for all Lamellicorn insects to feed upon the juices of plants.

Mr. Gray then read to the meeting a paper, 'On the Formation of Angular Lines on the Shells of certain Mollusca.'

The annular marks, and those in the direction of the growth of the shell, and in the substance of the shell itself, were easily explained by the increased or diminished degree of activity of the secreting surface of the mantle. But the coloured angular lines were not so easily explained. He supposed that the colouring of the shell was the consequence of glandular secretion: that, as the shell increased in size, there was a tendency to divergence in the glands. Now, it frequently happened, that, in the progress of growth, these glands were obliterated, and the immediate consequence of this obliteration was the production of a new gland: this gland was double, and, as it had a tendency to diverge, it formed two angular lines which proceeded to a certain distance, when it met with a gland formed in a similar way to itself, and, on meeting, it became obliterated: after this obliteration, a new double gland was formed, which proceeded in the same mode as the first, and thus produced the angular coloured lines apparent on so many shells.

A discussion ensued on this paper, in which several objections were brought forward to this theory, by Dr. Greville, Messrs. Douglass, Lankester, Sowerby, Wailes, and Tayler.—Mr. Gray stated, in answer, that he brought it forward, merely as a theory, to explain the fact.—On Sir William Jardine inquiring if any other gentleman had anything to say, Mr. Gray stated, that in the Museum of the Natural History Society, was the wombat which was sent by Bass to Bewick, and from which he took his original description: from a misprint, this specimen was said to have more teeth than it really has; and, on this account, Illiger having seen a specimen of the wombat, supposed this must be another genus, and has named this one in his work, *Amblotis wombattus*. The colour, too, of this specimen, assisted in the mistake, for, having been originally kept in spirit, it had lost its colour.

SECTION E.—MEDICAL SCIENCE.

President—T. E. Headlam, M.D.
Vice Presidents—Prof. Wm. Clark, M.D., John Yelloly, M.D., Mr. John Fife.
Secretaries—Mr. T. M. Greenhow, J. A. Vose, M.D.
Committee—P. M. Roget, M.D., A. B. Granville, M.D., R. S. Sargent, M.D., D. T. Evanson, M.D., C. J. B. Williams, M.D., J. C. Pritchard, M.D., Mr. John Baird, W. Lynch, M.D., N. T. Smith, M.D., Mr. William Fife, R. Reed, M.D., Chas. Wightman, M.D., J. Carson, jun. M.D., Prof. Owen, J. Reid, M.D., R. D. Thomson, M.D., Jos. Brown, M.D., Mr. Wm. Morrison.

A paper was read by Mr. T. M. Greenhow, 'On the Beneficial Action of Mercury rapidly introduced in certain cases of Neuralgia.'

After some general remarks on mercury as an important therapeutic agent, he stated the following conclusions, as generally derivable from its usual effects: 1st. In secondary syphilis, when slowly introduced into the system, much valuable time was frequently lost, as in iritis. 2nd. That the injurious effects of it, which were sometimes observed to follow its operation in syphilis, did not follow when administered for liver disease. 3rd. In syphilis, if not quickly beneficial, it proved detrimental, being either a "bane or antidote." 4th. That the mode of administration frequently decided which operation followed; and 5th. That in iritis and amaurosis, the beneficial effects were proportioned to the rapidity of its introduction into the system. Two cases were then detailed, in which the rapid introduction of mercury into the system proved completely successful, in removing severe and long-continued neuralgia,—the first occurring after a severe attack of hemiplegia, which was removed by ordinary treatment. The neuralgia recurred once after removal from the lower extremity in another situation, in the shoulder and arm, and was again relieved, and permanently, by the rapid action of calomel and opium. The second case of severe neuralgia occurred in a lady, who previously had given birth to still-born children. The violence and long continuance of the disease resisted all the usual external and internal remedies, and had shattered both mental and bodily health. The disease completely disappeared on the rapid introduction of mercury into the system, though it had previously resisted the slow action of the same remedy. Other painful afflictions were adduced, in proof of the efficacy of this mode of treatment, that could not be suspected of having any connexion with a syphilitic taint in the constitution.

Dr. Granville inquired as to the degree of salivation induced.—Mr. Greenhow replied, that a decided affection of the gums with slightly increased action of the salivary glands was enough, without profuse salivation.—Dr. Browne confirmed the observations contained in the paper, by cases in which mercurial action removed severe neuralgia, not connected with inflammation or syphilis.

Mr. R. M. Glover read a paper, 'On the Functions of the Rete Mucosum and Pigmentum Nigrum in the dark races, and particularly in the Negro; with Observations on a paper on the same subject by Sir Everard Home.'

The paper commenced by stating, that the degree of developement of the rete mucosum and its pigment, determined the power of resisting the excessive heat of the sun in tropical climates, as evinced by the Negro (the type, in this respect, of the dark races), the European and the Albino. The *modus operandi* must be discovered by an attention to both the physical and vital properties of this peculiar organization. The doctrine at present taught on the subject is, that the black skin absorbs more heat, but that the cutis vera of the negro is not so liable to inflammation from a high temperature, as that of a European from a lower temperature; and as the radiation of caloric from black must be greater than from white skins, the possessor of the former must cool more readily, and enjoy greater alternations of heat and cold. The former part of this doctrine is founded on the experiments and deductions of Sir Everard Home, as detailed in his paper in the Philosophical Transactions. A number of experiments detailed in the paper on the vesicatory powers of differently coloured substances, under the concentrated rays of the sun, contradicted the deductions of Sir E. Home, and hence arose the necessity of looking to the vital properties of the skin of the negro, and the mode in which it is likely to be affected by the radiating and absorbing power of the pigment with which he is provided. Blumenbach and Winterbottom state, that the negro perspires more readily and freely than the European—and Davy says, "In the inhabitants of the tropics, the exhalant arteries of the skin seem unusually expanded, and the whole apparatus peculiar to this secretion unusually developed; and I believe that the blood itself is less viscid, more fluid, and flows more readily through the vessels, so as to promote perspiration, and by that means contributing to the cooling of the surface. And being cooled itself, it contributes again, when it flows back upon the heart, to the reduction of the temperature of the internal parts." Were the inhabitant of the tropics not possessed of this peculiar organization, his system could not respond to the stimulus of heat, by a determination of fluid towards the surface. Doubtless, the excessive absorption of heat by his skin, is useful in promoting this effect; but in the system qualified to respond to the stimulus of heat, and not in the organization of the skin alone, must an explanation be sought of the capability of the negro to withstand the heat of tropical regions.

In the next paper, Dr. John Reid gave an account of 'An Experimental Investigation of the Functions of the Eighth Pair of Nerves.'

This communication contained some of the principal results which Dr. Reid has obtained in prosecuting this inquiry since the last meeting of the Association. Dr. Reid chiefly confined himself to the Pulmonary and Gastric branches of the Nervus Vagus. In a great number of experiments upon dogs, in which the nervi vagi and recurrents were divided, Dr. Reid satisfied himself, that when a sufficient quantity of air reached the lungs, the respirations were at first performed with ease. The only immediate and constant effect observed was, a great diminution in the number of the respiratory movements, which at the same time became slower and more heaving. When the number of respirations were from 16 to 20 in a minute, they, in general, instantly fell to from 6 to 8. In one animal, in which they were from 24 to 28, they immediately fell to 14; and, in another animal, in which they were 24, they fell to 8. At a longer or shorter period after section of the nerves, the inspirations became more prolonged and heaving, while the expirations continued to be comparatively short and rapid, and attended by a sound caused by the sudden expulsion of the air. After a time, the inspirations become more heaving and prolonged, the blood is less perfectly arterialized in the lungs, and the arteries circulate blood gradually approaching the venous character; the animal becomes dull and stupid, and dies asphyxiated. In tracing the morbid changes upon the lungs, which follow section of the vagi, Dr. Reid has satisfied himself, from the dissection of animals killed at various periods after section of the vagi, that the blood-vessels of the lungs become gradually loaded with blood, and that this, in a few cases, is the only change which can be observed after death. More frequently, however, this congestion of the lungs gives rise to effusion of serum, which, in the bronchial tubes, is rendered frothy by the passage of air through it; to condensation of portions of the lung without any apparent effusion of lymph; and more rarely to true pneumonia. The respiratory murmur is little, if at all, changed for a short time, but it afterwards becomes bronchial; and, when the effusion of serum takes place, the true *crepitans râle* may be heard. It appears, however, that these morbid changes in the lungs do not necessarily take place after section of both vagi and recurrents. In a dog, which was killed in the presence of Dr. Alison, twelve days after section of the vagi and recurrents, and which had apparently recovered from the effects of the operation, the lungs were found perfectly healthy, though the cut ends of both vagi were rather more than one inch distant from each other. Dr. Reid believes that the diminished frequency of the respiratory movements is sufficient to explain all the morbid changes in the lungs, which result from section of the nervi vagi. He related several experiments to prove, that the respiratory movements are not arrested by division of the vagi and recurrents after removal of the cerebrum and cerebellum. In these experiments, it was, however, observed, that though section of the vagi did not arrest the respiratory muscular movements, they were much diminished in frequency. While these experiments illustrate the great importance of the par vagum as exciters of respiration, they also prove that there are other nerves which can transmit those impressions to the me dull

oblongata, which excite the respiratory movements; and Dr. Reid adduced some facts to show, that one of the most important of these was the larger root of the fifth pair distributed upon the face. Dr. Reid then related four experiments, which he considered to afford satisfactory evidences of the continuance of digestion after section of both vagi, with loss of substance. In three of these, the lacteals and thoracic duct were found full of chyle. From these experiments, he concluded, that, though by division of the vagi a deleterious influence is propagated downward to the stomach, disturbing the functions of the digestive organs; yet, if the animal live long enough, this goes off, and digestion proceeds as before. He related some experiments to prove, that alcohol, opium, and prussic acid exert their deleterious effects as rapidly when injected into the stomach after division of the vagi, as when these nerves are left entire. He then detailed the result of five comparative experiments upon the effects of fatal doses of arsenic upon the watery and mucous secretions from the inner surface of the stomach and intestines. These results were completely at variance with the statement of Sir B. Brodie, that section of the vagi arrests the usual mucous and watery secretions of the stomach and intestines observed after poisoning with arsenic. He stated, that he had of late carefully watched the effects of division of the sympathetic nerve on the eye, and that he had satisfied himself that the contracted state of the pupil, and the partially-closed eyelids, which accompany the inflammation of the conjunctiva, consequent upon section of the sympathetic, take place previously to the inflammation of the conjunctiva, and are independent of it.

Prof. Owen requested to know, if albumen were discovered in the thoracic duct after the division of the vagi nerves. Dr. Reid replied, that no chemical analysis was made of the contents, but true digestion was inferred by him from the return of health and activity to the animal operated on.—Dr. Golding Bird pressed the same objection as Professor Owen, and wished that an experiment on the subject should be followed up by such a chemical investigation as would be decisive.

Section F.—STATISTICS.

President—Colonel Sykes.
Vice Presidents—Sir Chas. Lemon, Bart. Messrs. G. R. Porter, Charles W. Bigge.
Secretaries—Messrs. James Heywood, W. R. Wood, W. Cargill.
Committee—Sir M. W. Ridley, Bart., Messrs. G. W. Wood, James Losh, Dr. Taylor, Rev. W. Turner, Jun., Messrs. Rawson W. Rawson, William Felkin, John Shuttleworth, Henry Romilly, Dr. Bowring, General Briggs, Messrs. W. H. Charlton, L. Hindmarsh, Rev. Joseph M'Alister, Messrs. S. Turner, J. Aspinall Turner, W. L. Wharton, C. G. L. Menteath, J. M. Morgan, S. Hare.

The first paper read was a Report from Mr. John Stephens, superintendent of police, 'On the state of Crime in Newcastle, during the last ten months.' It was simply such a return as is usually made from police offices, and we shall therefore only give the more remarkable particulars.

The population of Newcastle is about 60,000; the number of persons brought to trial for offences of every class, was rather more than 3000, or 1 in 20 of the population. Under the general laws, 1274 were convicted, 20 acquitted, and 875 discharged. Under the by-laws, or police regulations of the town, 284 were convicted, and 98 discharged; most of these were, however, brought up for very trifling offences—351 for being drunk and disturbing the peace, 134 for being found helplessly drunk in the streets. Since October, 1837, it had been ascertained by the police that 78 persons had returned to courses of honest industry, and 175 had disappeared. The report did not notice the number of re-committals, nor the proportions of the educated to the uneducated; but it was stated generally that the re-committals were very numerous, and that the uneducated formed far the greater majority of the prisoners.

In the desultory discussion which arose on this paper, Mr. Owen stated that in New Lanark, containing a population of 2500, during 29 years there had not been a single case of crime, nor occasion for consulting a lawyer.—It having been mentioned that mining districts are generally most free from crime, Sir C. Lemon accounted for it by the greater regularity of mining employment, the higher rate of wages, the superior instruction, and the absence of hostility to machinery.—Mr. Cargill said, that when the wages of the pitmen round Newcastle were less than they are now, crime was far more abundant; he added, that much improvement in the moral condition of the colliers had been effected by the labours of the Wesleyan methodists.

'A Statistical View of the Recent Progress, and Present Amount of Mining Industry in France,' by Mr. G. R. Porter. A paper on this subject was some time since read, by the same gentleman, at the meeting of the Statistical Society, and may be referred to by persons interested in the subject (*Athenæum*, No. 483). In the present, however, particular branches of the inquiry are treated of more at length, and the report is brought down to a later period.

Mr. Porter began by a general reference to the importance of the subject, and observed, that it is surprising that, among a people so proverbially practical as we are, such researches should be so little the subjects of inquiry as they hitherto have been: even the amount of one of the most important of our mineral products is so much left to conjecture, that the produce of our coal-mines at the present day is variously estimated by men conversant with the subject, at from 15,000,000 to 30,000,000 of tons per annum. In France, however, a law was passed, in April 1833, which gave authority to collect statistical details of the mining industry of France, and intrusted the execution of the duties enjoined to a public department, known as the 'Direction Générale des Ponts et Chaussées et des Mines,' and placed under the ultimate control of the minister of commerce and public works. Attached to this department is a staff of well-instructed, able engineers, who make a personal inspection of every establishment connected with mining operations; and a report is carefully drawn up from materials supplied by these officers, and presented every year to the minister of public works. These reports present a most elaborate view of every branch of mineral industry in each department of the kingdom; and from tables, the results of which will be given hereafter, it will be seen at what a rapid rate of increase the mineral resources of France have of late years been developed—a rate which Mr. Porter thought might reasonably suggest the probability of its being in some part owing to the public attention having been drawn to the subject, and still more to suggestions offered to the proprietors of works by accomplished engineers at times when the works have been inspected. The increase in the value of coal, iron, lead, antimony, copper, manganese, alum, and sulphate of iron, since the system of inspection was begun, has been from 105,750,995 fr. (4,230,039*l.*), in 1832, to 154,228,455 fr. (6,169,138*l.*), in 1836, or 45 per cent., as under:—

	1832.	1836.
	Francs.	Francs.
Coal, Lignite, and Anthracite ..	16,079,670	26,607,071
Iron and Steel	87,312,994	124,384,616
Silver and Lead	856,673	821,534
Antimony	71,233	305,032
Copper	247,680	196,924
Manganese	105,150	152,671
Alum and Sulphate of Iron	1,077,595	1,760,607
Total	105,750,995	154,228,455

The increase experienced in the same branches during the four years that preceded these inspections, viz. from 1828 to 1832, amounted to no more than 304,392 fr., or 12,175*l.*, while the increase experienced during an equal period under the system of inspection, viz. from 1832 to 1836, has been, as above stated, 48,477,460 fr., or 1,939,098*l.*

Coal.—There are 46 coal-fields (*Bassins houillers*) from which that mineral is obtained in France. These coal-fields are situated in the following departments, 30 in number, which are here arranged in the order of their productiveness, as shown by the quantity procured in 1835, and stated in English tons:—

	Tons.		Tons.
Loire	812,914	Rhône	7,463
Nord	531,605	Mayenne	6,206
Saône et Loire ..	142,149	Ardèche	5,229
Aveyron	119,152	Pas-de-Calais	3,736
Gard	45,569	Moselle	3,015
Calvados	41,511	Correze	1,763
Nièvre	30,162	Creuse	1,576
Haute Loire	21,883	Vosges	1,356
Loire Inférieure	21,742	Dordogne	1,000
Tarn	18,420	Haut Rhin	537
Hérault	16,201	Vendée	504
Haute Saône	16,128	Bas Rhin	177
Allier	13,826	Cantal	177
Maine et Loire ..	11,556	Lot	60
Puy-de-Dôme ..	11,387	Aude	22

There are 45 separate mining establishments, which extend over an area of 42,038 English acres. A table is subjoined, in which are stated the quantity and value, in English measure and money, of the coal, lignite, and anthracite respectively, raised in all the departments of France in each year, from 1814 to 1836. It will be seen from this table that the produce has been increased from 675,747 tons, in 1814, to 2,583,587 tons in 1835, or 282 per cent. If this interval of time is divided into three nearly equal periods, the average annual produce in each period has been as follows:—

7 years—1814 to 1820.. 792,496 tons.
8 „ 1821 „ 1828..1,197,491 „ Increase, 51 per cent.
8 „ 1829 „ 1836..1,835,831 „ „ 53 „ from 2nd period.

The increase, comparing the 1st and 3rd periods, is 131 per cent.

The whole number of mines in operation in 1836 was,—

Coal.....	189	employing	19,813 workmen.
Lignite	44	„	1,181 „
Anthracite....	25	„	919 „
Total....	258	„	21,913 „

Great as the increase has been of late years in the produce of the French coal-mines, the inspectors predict that this branch of the national industry will shortly exhibit a more rapid progress than any hitherto seen. Large establishments are in the course of formation in the great field of the Loire, as well as in other localities; and it is expected that the opening of cheaper means of communication will give an impulse to coal-mining in quarters where it has hitherto been scarcely attempted.

Statement of the Quantity and Value of Coal, Lignite, and Anthracite, raised in France, in each year, from 1814 to 1836.

Years.	Coal. Tons.	Coal. Value. £.	Lignite. Tons.	Lignite. Value. £.	Anthracite. Tons.	Anthracite. Value. £.	Total. Tons.	Total. Value. £.
1814	636,835	261,112	23,666	9,161	5,689	1,824	665,610	272,097
1815	715,276	324,923	23,300	11,698	5,735	1,985	744,311	338,416
1816	764,765	322,648	11,239	4,723	4,723	1,646	795,012	335,533
1817	815,229	342,976	27,340	16,660	4,572	1,579	847,141	360,615
1818	723,471	313,704	29,600	14,562	2,130	2,130	755,201	330,396
1819	761,860	333,518	44,113	11,846	8,037	4,374	813,950	349,738
1820	671,980	370,114	43,977	21,464	7,405	3,837	923,362	395,405
1821	913,213	395,771	36,122	19,344	8,290	2,490	958,011	417,605
1822	950,899	400,842	48,693	21,316	8,290	3,773	1,007,722	425,931
1823	950,642	404,846	49,194	22,389	9,313	4,567	1,009,149	431,752
1824	1,065,016	435,695	41,032	19,897	13,222	6,481	1,119,270	462,073
1825	1,176,538	482,698	59,242	25,008	23,374	9,915	1,259,154	517,621
1826	1,217,963	520,812	66,116	29,201	14,966	5,992	1,301,045	556,005
1827	1,344,432	557,130	57,838	35,214	25,483	12,185	1,427,753	604,529
1828	1,403,239	565,783	64,939	29,647	14,969	12,165	1,497,825	607,466
1829	1,378,136	539,847	68,719	22,747	16,884	16,221	1,470,367	579,478
1830	1,477,513	562,118	74,348	24,680	16,221	30,761	1,572,022	622,959
1831	1,463,124	549,452	83,513	19,723	16,736	30,631	1,486,368	585,901
1832	1,549,636	600,369	69,177	22,314	20,403	39,698	1,657,211	643,186
1833	1,633,776	672,893	58,274	26,160	35,288	45,180	1,737,330	724,341
1834	1,962,085	748,946	86,064	31,166	30,715	53,997	2,102,136	810,837
1835	1,957,022	793,201	101,566	39,433	35,532	87,603	2,116,133	865,246
1836	2,304,299	1,000,018	96,240	39,514	44,288	64,290	2,544,835	1,104,202

In this Table metrical quintals are converted into English tons at the rate of 10.1465 metrical quintals to a ton, and francs are reduced to sterling money at the exchange of 25 fr. per pound sterling: fractions are discarded.

During the years embraced in the foregoing table the use of coal in France has increased in a greater degree than the productiveness of the mines, as will be seen from the following statement of the quantity imported for consumption (*commerce special*), in each year from 1815 to 1836:—

	Tons.		Tons.
1815	245,653	1826	495,325
1816	315,815	1827	531,800
1817	235,269	1828	570,010
1818	277,624	1829	539,247
1819	234,102	1830	621,459
1820	276,705	1831	533,259
1821	315,785	1832	567,251
1822	332,192	1833	686,116
1823	321,497	1834	730,281
1824	456,644	1835	755,365
1825	499,325	1836	949,373

The greater importations of the last three years

have been encouraged by a partial diminution in the rate of duty on consumption—a measure rendered necessary by the rapid extension of steam navigation.

Iron.—At the present time France occupies the second rank among nations as regards the production of iron, England being still immeasurably in advance of France, in which country the extension of this branch of industry is far less than has been effected of late years with us. There are at this time in France twelve distinct localities or districts, in which the making of iron is prosecuted, which are thus distinguished in the official reports:—1. Group of the North-east; 2. of the North-west; 3. of the Vosges; 4. of the Jura; 5. of Champagne and Burgundy; 6. of the Centre; 7. of the Indre and La Vendée; 8. of the coal-fields of the South; 9. of Périgord; 10. of the Alps; 11. of the Landes; 12. of the Pyrenees.

The actual and relative importance of these groups may be seen from the following particulars, given in the Report presented in the present year, and having reference to the working of 1836.

Group.	Number of Iron Works.	Number of Workmen.	Quantity of Fuel in Tons and Steres.				Quantity of Products.			Value of Products in English Money.
			Wood Charcoal.	Coke.	Coal.	Wood.	Cast Iron.	Bar Iron.	Steel.	£.
			Tons.	Tons.	Tons.	Steres.	Tons.	Tons.	Tons.	
1	94	2,233	90,844	3,530	8,230	33,583	46,233	30,450	162	530,599
2	59	1,771	54,651		2,964		23,755	11,182		210,238
3	7	388			24,430		2,236	9,189		147,500
4	146	2,699	126,754	7,315	910		54,737	98,900	581	652,030
5	152	2,007	139,602		40,947		81,499	42,309		691,526
6	134	2,153	71,998	14,004	35,796		36,993	37,029	766	501,362
7	21	499	17,564	67,444			5,824	2,870		61,065
8	15	1,243		115,038			28,440	97,276		377,158
9	115	1,175	39,120	3,999			14,883	9,084	96	173,646
10	39	174	6,614		231		2,021	982	1,120	6,916
11	31	410	17,466		32	476	7,118	3,674		62,535
12	99	815	30,742					9,466		171,140
	894	15,738	593,355	112,383	232,399	34,061	303,739	261,691	2,725	3,585,737

The figures given in the foregoing table do not present in all their importance the extent of this branch of industry in France. The number of workmen employed for the production of pig-iron (*fonte*), malleable iron (*gros fer*), and steel, which alone are there included, does not much exceed one-third of the number engaged in all the various processes of the iron manufacture; and the total value of the material produced, instead of being, as in the above statement, 3,585,739*l.*, amounted in 1836, according to the returns of the inspectors, to 4,975,424*l.* The following abstract contains all that it appears desirable to offer on this occasion, and presents under five principal divisions the total number of workmen engaged in the manufacture, with the value created by them in each of those divisions:—

	Number of Workmen.	Value created.
		£.
1. Extraction and Preparation of the Ore	17,557	500,632
2. Production of Pig-Iron (*fonte*)	6,776	1,969,132
3. Production of Malleable Iron (*gros fer*)	8,678	1,506,247
4. Founding, Drawing, Rolling, &c.	8,615	812,496
5. Converting, Moulting, Casting, &c. Steel	2,149	186,927
Total	43,775	4,975,424

Rather more than 40 per cent. of the value here stated is made up of the cost of the fuel used in the various processes, viz.—

Wood Charcoal	£1,643,826
Wood	13,040
Coke	96,972
Coal	285,235
Peat	694
	£2,039,767

This sum is divided among the different processes in the following proportions:—

	£.	Decim. Propn.
1. Roasting the Ore	1,782	0.087
2. Smelting	1,132,039	55.500
3. Refining, Puddling Furnaces, &c. &c.	737,888	36.175
4. Casting, Drawing, Rolling, &c.	121,556	5.959
5. Moulding, Casting, &c. Steel	46,502	2.279
Total	2,039,767	100.000

It will be seen that four-fifths in value of the fuel is composed of wood. Coke was not used in the iron-works of France until 1821, and at the present time is employed almost exclusively for processes subsequent to smelting the ore. The proportionate value of different kinds of fuel consumed in the various processes in each year, from 1833 to 1836 has been:—

	1833	1834	1835	1836
Wood Charcoal	0.838	0.818	0.864	0.806
Coal	0.098	0.129	0.098	0.140
Coke	0.062	0.050	0.037	0.048
Wood	0.002	0.003	0.001	0.006
	1.000	1.000	1.000	1.000

The average prices of the different kinds of fuel in 1836, as stated in the Report, were—

Wood Charcoal	54*s.*	10*d.*	per ton.
Coal	18	5	..
Coke	20	3	..
Wood	2	10	per stere.

The increased proportion of wood, observable in the working of 1836, is caused by the substitution in part, in some works, of wood dried by heat or partially carbonized. By the introduction of a proportion of dry wood in place of charcoal, a diminution in the cost of fuel has been attained, but against this advantage must be placed the smaller produce obtained from the furnace in a given time, as well as a diminution of metal from a given quantity of ore.—Where wood charcoal alone is used for smelting, it requires eighteen metrical quintals for the production of thirteen metrical quintals of iron. Where coke and coal are used in the proportion of ten of the former to nine of the latter, it requires about three quintals of fuel to produce one quintal of iron. In some cases, coke is used with charcoal in the proportion of one quintal of coke to two quintals of charcoal, and the produce has been eight quintals of iron for ten quintals of fuel. In the first case (where wood charcoal is used), the cost of the fuel has been 9.92 fr. per metrical quintal of iron, or 4*l.* 0*s.* 6*d.* per English ton. The cost when coke and coal are used, is stated to be 4.45 fr. per quintal, or 36*s.* 1½*d.* per ton; and in the third case, where coke and charcoal are mixed, the cost is said to be 7.60 fr. per quintal, or 3*l.* 1*s.* 8*d.* per ton. The value assigned to the produce is,—

	Per ton.
In the first case .. 20.99 fr. per quintal, equal to	£8 10 4
In the second case, 11.13 fr. ,, ,,	4 10 4
In the third case .. 20.32 fr. ,, ,,	8 4 11

The mixture of coke and charcoal would, upon the whole, appear to be the most profitable in its result. Deducting from the value of the metal the sum expended for fuel, there would remain, when charcoal alone is used, 4*l.* 9*s.* 10*d.* per ton; when coal and coke are used, 2*l.* 14*s.* 2½*d.* per ton; and when coke and charcoal are used, 5*l.* 3*s.* 3*d.* per ton. These calculations are of course wholly inapplicable to the circumstances in which the manufacture is placed in this country, from the actual and relative cheapness of our mineral fuel.—The use of the hot blast has been adopted in several of the furnaces in France. At first it was found that the iron thus obtained was not so well adapted for making bar iron as that for the smelting of which cold air had been used; but some modifications, which are not particularized in the Reports, have been introduced into the process, and this advantage has been remedied. No account is given of the quantity of iron made in France earlier than 1824; but from that year the account is regularly stated in the Reports from which the following abstract has been computed:—

	Pig-iron.	Malleable Iron.
	English Tons.	English Tons.
1824	194,636	139,564
1825	195,588	141,396
1826	202,756	143,336
1827	213,175	146,621
1828	217,604	149,117
1829	213,868	151,319
1830	222,965	146,242
1831	221,423	138,942
1832	221,660	141,336
1833	232,559	149,982
1834	265,028	174,507
1835	290,378	206,396
1836	303,739	201,691

As in the case of coals, the importations of foreign iron into France have kept pace with the increase in the native production. The Custom House accounts of that country are detailed with great minuteness; but it is not necessary here to particularize the quantities of each description of foreign iron used in France. The value so consumed in each year since 1815, and the amount of duty collected on the same, were as follows:—

Years.	Value of Foreign Iron imported for use.	Amount of duty collected.	Years.	Value of Foreign Iron imported for use.	Amount of duty collected.
	£.	£.		£.	£.
1815	87,556	29,840	1826	218,212	130,326
1816	98,063	45,600	1827	186,846	98,960
1817	202,205	122,024	1828	179,635	95,073
1818	163,173	89,491	1829	160,625	84,396
1819	164,238	94,180	1830	187,117	100,476
1820	162,107	81,517	1831	123,185	63,644
1821	226,571	126,945	1832	159,222	82,192
1822	144,193	74,540	1833	174,601	91,569
1823	141,501	86,258	1834	200,573	104,598
1824	164,812	94,157	1835	231,208	121,346
1825	150,690	86,894	1836	252,702	122,842

The production in France of metals, other than iron, is of little or no commercial importance at the present time. The whole value created in the articles of lead and silver, antimony, copper, and manganese, amounted in 1836 to less than 60,000*l.*, and gave employment to only 1760 workmen. In noticing this fact the inspectors encourage the hope that some considerable addition may shortly be made to the produce of mining industry applied to the articles just enumerated; they do not, however, explain the grounds upon which this hope should be entertained, further than by noticing the existence in the country of several promising fields for that industry hitherto allowed to remain unproductive, and by stating that they are occupied in collecting information which may serve to facilitate the future attempts of persons desirous of embarking their energies and their capital in this direction.

Lead and Silver.—There are eleven lead mines in operation in France, situated as under:—

		Tons.		
Hautes Alpes	2, produced, in 1836,	46,	valued at	£ 1,175
Finistère	1 ,,	504	,,	11,692
Gard	1 ,,	4	,,	80
Isère	1 ,,	54	,,	848
Loire	1 ,,	22	,,	260
Lozère	1 ,,	47	,,	1,316
Puy-de-Dôme	1 ,,	30	,,	740
Rhône	3 ,,	6	,,	98
	11	713		£16,209

The silver obtained from the soil of France is separated from the produce of some of the lead mines above mentioned: the quantity and value thus yielded in 1836 were,—

Hautes Alpes	203 lb.	valued at	£660
Finistere	3,517	,,	11,542
Lozère	1,028	,,	3,388
Puy-de-Dôme	324	,,	1,060
	5,072		£16,650

The value put upon this produce in the Report is thus 5*s.* 6*d.* per oz.

The quantity of lead of native production supplies but a small part of the wants of the country. The importations into France from foreign countries, principally Spain, for consumption during the five years from 1832 to 1836, have averaged 14,800 tons per annum.

Antimony.—This mineral is produced in France from eleven mines, viz.—

		Tons.		
Allier	1, produced, in 1836,	138,	valued at	£3,864
Ardèche	1 ,,	63	,,	1,944
Gard.....	1 ,,	23	,,	626
Haute-Loire ..	2 ,,	22	,,	652
Lozere.....	4 ,,	35	,,	960
Puy-de-Dôme..	2 ,,	130	,,	4,073
	11	411		£12,121

Copper.—The produce of copper mines in France, five in number, is inconsiderable: three of these mines are in the department of Hautes Alpes, and two are in the department of the Rhone. The quantity of metallic copper which they yielded in 1836 was only 102 tons, and its value 7,877*l.* The yearly consumption of foreign copper, principally the produce of Russia and of England, during the five years from 1832 to 1836, has averaged 6,235 tons.

Manganese.—The manganese mines are situated as follows:—

		Tons.		
Allier	1, produced, in 1836,	365,	valued at	£1,628
Aude	1 ,,	148	,,	570
Dordogne	3 ,,	215	,,	951
Haute-Saône ..	1 ,,	39	,,	31
Saône-et-Loire.	1 ,,	900	,,	2,926
	7 Mines.	1,667 Tons.		£6,106

The engineers to whom the task of inspecting the mining establishments of France is intrusted, have not confined their inquiries to the objects which have been noticed in this paper: they have included in their Annual Reports the statistics of various branches of industry in which mineral substances are produced or employed; such as bituminous minerals—alum—sulphate of iron—and salt; the produce of quarries—of glass-houses—of porcelain and pottery manufactories—of copper and zinc works—and of chemical processes. By this means, it is shown that the number of workmen who, in 1836, depended for subsistence upon mining operations and their consequences, amounted to 273,364; while the total value created by their joint labour amounted to 377,684,791 fr., or 15,107,392*l.* viz.—

	Establishments.	Workmen.	Value created.
			Francs.
Coal, Lignite, Anthracite, and Peat	2,219	55,735	30,533,922
Iron and Steel.....	—	43,775	124,385,616
Lead, Silver, Copper, Antimony, Manganese.....	—	1,770	1,476,161
Bitumens.....	6	245	192,128
Alum and Sulphate of Iron..	19	1,141	1,760,667
Salt	—	16,615	10,397,164
Quarries	—	70,396	40,350,419
Glass Manufactures	—	10,497	47,474,301
Porcelain, Pottery, and Earthenware	—	20,435	27,418,122
Bricks and Tiles, and Lime..	—	44,604	51,939,239
Plaster.....	—	4,298	14,713,796
Chemical Products	—	2,216	22,043,732
Copper, Zinc, & Lead Works.	—	1,597	4,999,524
		273,374	377,684,791

Dr. Bowring observed, that this Report, like every report communicated by government agents, gave far too favourable a view of the mineral prosperity of France. Two of the institutions to which reference had been made—the mining establishments of Bassin du Creussot and the iron works of Decazeville—were not merely losing, but ruinous concerns; and the latter had been forced to import pig-iron from England. The injurious effects of the perversion of French industry to branches of production, for which the country possessed no natural advantages, was evidenced by comparing the number of ploughs in an agricultural district of France, with a district of the same extent in England, and the result would show that our country had the advantage, in the proportion of five to one. The cottagers in France, as most travellers have observed, were generally destitute of carpenters' tools, nails, and other little implements necessary to economy and comfort. Though the French engineers talked of the increased productiveness of their mines, they did not add, that iron in France was from 5*l.* to 7*l.* per ton dearer than in England; and as 300,000 tons of iron are annually consumed in that country, it followed that the French were taxed to the amount of more than a million and a half annually, to afford speculators in mines an opportunity of ruining themselves. —Mr. Felkin considered it of vital importance to have a correct statistical account of our mineral and manufacturing resources published to the world. Though the speculations to which Dr. Bowring had referred, had proved ruinous to the projectors, yet they were not abandoned; and it would be idle to deny, in reference to the competitive situation of England and France, that machinery and fixed capital, accumulated on a spot, must be worked, even at a loss; and he believed that the Manchester manufacturers had already felt such establishments to be a thorn in their side. The workmen of France were a patient, industrious, and temperate race. The state of the Savings Banks in that country reflected great credit on the character of the operatives, and was calculated to gratify every person who, laying aside the prejudices and jealousies of country, was gratified by the progressive improvement of our race, no matter in what locality, as a triumph of philanthropy.

Colonel Sykes then read a very minute and detailed account of the 'Statistics of Vitality in Cadiz.' An immense mass of valuable tables and returns was submitted to the Section; but it will be sufficient here to state the general results. The population of Cadiz, according to the census taken in December last, amounts to 58,525 souls, consisting of 27,301 males, and 31,224 females,—the latter exceeding the former in the proportion of 53.35 per cent. to 46.65 per cent.; and this population, from the circumstance of Cadiz being a walled town, and always filled, may be regarded as a constant quantity. From the registries of the general cemetery, extending from 1800 to 1837 inclusive, it appeared that the total number of deaths in thirty-eight years was 110,345; but this included four years, 1800, 1804, 1810, and 1819, during which the yellow fever raged.

Annual average of burials in 38 years, 2640, or 4.51 per cent.		
Ditto, in 34 years, excluding years of fever	2523, or 4.31	—
Ditto, 4 years of fever	2903, or 4.96	—
Ditto, last 15 years	2334, or 3.93	—

Children in whole period, 35.56 per cent., or 1 in every 2.59 deaths.

These returns vary considerably from those presented by the parish registers, which do not include deaths in hospitals, &c.; and this circumstance shows the great care necessary in collecting and checking statistical returns. The mortality in the Foundling Hospital at Cadiz is very great. In 1837, out of 1250 admitted, or remaining since 1836, the deaths, including 91 found dead in the rotatory box, was 524, or 41.91 per cent. of the whole, or one death of an infant in every 2.48 received. The deaths among the foundlings in Paris, in 1835, were 21 per cent., that is, little more than one-half the mortality of foundlings at Cadiz. Having struck various averages to exhibit the mortality in Cadiz in the most favourable light, it appears that the value of life in that city is less than in any other place in Europe from which returns have been obtained; but it is a remarkable fact, that this rate of mortality does not extend beyond the walls. An English sloop of war, during two years that she lay in the harbour, lost only two out of a crew of 190; and one of these was the victim of accident.

A long and desultory discussion followed, but no fact of importance was elicited.

Section G.—MECHANICAL SCIENCE.

President—Mr. Charles Babbage.
Vice Presidents—Mr. Bryan Donkin, Sir John Robison, Mr. G. Stephenson, Prof. Willis.
Secretaries—Messrs. R. Hawthorn, T. Webster, C. Vignolles.
Committee—Messrs. R. W. Brandling, W. Carpmael, Peter Clare, G. Dollond, W. Fairbairne, J. I. Hawkins, E. Hodgkinson, Dr. Lardner, Messrs. J. Marcus, R. Roberts, J. Scott Russell, R. Stephenson, J. B. Thompson, W. L. Wharton, Nicholas Wood, John Taylor, J. Nasmyth, J. Marshall, Ed. John Dent.

Charles Babbage, Esq., President, in the chair.—The following communications were brought forward:—

'On a new Day and Night Telegraph,' by Joseph Garnett.

The paper on this subject was accompanied by a model, to exhibit the construction and method of working of the telegraph, which it is proposed should consist of two ladders, about forty-one feet long, framed together at about twenty-four inches asunder at the bottom, and twenty at the top, so as to constitute the frame for the machinery. There are two arms, one at the top, the other about midway up the frame-work, counterpoised by weights, and worked by machinery, consisting of eight bevel mitre wheels. At the bottom of the frame-work, is a dial plate, with a pointer, and the workman, in setting the pointer, brings the arm of the telegraph into the required corresponding position. The paper proceeded to describe the mechanical adjustments, and was accompanied by tables of the day and night signals, each of which contains fifty-six variations of the arms. The night signals are made by covering the lamps in a particular order. For instance, two vertical lamps covered designate twenty—two horizontal ones covered thirty—and so on.

'On Isometrical Drawing,' by Thomas Sopwith.

The object of the author in this communication was, to call attention to certain instruments, by which the operation of isometrical projection is greatly facilitated. These are a set of triangular rulers, drawing paper, with the lines and ellipses described upon it, and the isograph, which consists of a number of rulers, made of brass or ivory, the fiducial edge of each being an inch apart, and parallel to each other. The triangular rulers are serviceable for making projections of the angles of isometrical cubes, and the isograph is peculiarly adapted for copying maps. Some specimens of maps so copied were exhibited. Mr. Sopwith gave a detailed account of the way in which he used the above instruments for the purposes of isometrical projection.

'Description of an improved method of constructing large Secretaires and Writing Tables,' by Thomas Sopwith.

The great loss of time to persons engaged in extensive official business, in consequence of the difficulty of arranging numerous sets of papers, and of obtaining access to them when so arranged, induced the author to take this opportunity of describing a table invented by himself, and which had been extremely serviceable to him. The principle is, that by opening a single lock, the whole of the drawers, closets, and partitions are opened. These are so disposed, also, as to admit of everything being reached without the person stirring from his seat. They are all entirely closed again by a single spring lock. It would be impossible to convey a proper idea of this ingenious invention without sectional plans and elevations; but the President, and many present, expressed their admiration of the arrangements, and of the convenience which such a table must be to every person engaged in an extensive correspondence, or having many sets of papers on various subjects. One contrivance is peculiarly worth mentioning. Within this case, Mr. Sopwith hangs up his various keys. On any key being removed, a small counterbalance weight, or bolt, drops down, and remains down until the key is replaced. This bolt effectually prevents the closing of the case. If, then, the person should forget to replace the key which has been removed, he is immediately reminded of it, by being unable to close the case. The principle and contrivances are applicable to many various arrangements of drawers and partitions.

'On the Power of Economising and Regulating Heat for Domestic Purposes,' by George Webb Hall.

The author insisted on the necessity of having the backs of the fire-places vertical, and the apertures of the chimneys as contracted as possible; and he described the results of his experiments. One principle to be universally attended to in close fire-places is, that the burning fuel be surrounded by a substance retentive of heat, and capable of radiating it back upon the fire itself. This is attained by covering the fire itself with a species of fire-brick, and only allowing a very small aperture for the escape of the heat thus forced off at the highest degree attainable, then to be economised by close confinement and regulation. The economy of heat when attained, consists in conducting the hot air through long and horizontal flues, so as to counteract as much as possible its tendency to ascend, which tendency is exactly proportional to the temperature. The author illustrated the preceding paper by details of the arrangements which he had adopted, and alluded especially to the researches of Rumford on this subject.

Sir John Robison remarked, that he had paid considerable attention to this subject, and to its practical applications; but, he had done nothing more than endeavour to follow out the principles which were laid down by Mr. Sylvester in his account of Mr. Strutt's method of warming the Derby Infirmary. He would also call attention to the accounts in Loudon's Cottage Economy, and to two papers in the *Architectural Magazine*, the one by Dr. Ure, the other by Mr. Ritchie, on the subject of warming and ventilating.—The President remarked, that great care

was requisite in all experiments on the above subjects, especially with reference to the heat of smoke in the flues. He had once observed the smoke at two feet from the exit to be 190° Fahrenheit, the water in the hot water apparatus being 260° Fahrenheit; the slightest change in one damper caused the temperature of the smoke in the flue to fall almost immediately to 160° Fahrenheit, and that of the water to rise to 290° Fahrenheit. Thus, by a slight alteration in the damper, about 60° Fahrenheit was saved.

'Notices on the Resistance of Water,' by John Scott Russell.

Mr. Russell stated, that the observations he had to offer might be considered as a sequel to what had been given at the preceding meetings of the Association. He and Sir John Robison had been constituted a committee to prosecute the investigation of the motion of waves, and other problems in hydrodynamics, the results of which would be given in the Physical Section. But, as they went on, they had met with some results of great value to the practical man; of these, he now proposed to give a brief account to the Section. The general problem was the resistance of a fluid to a floating solid. Now, this is a department of science, of which we are avowedly ignorant; so much so, that some of our best vessels are acknowledged to be constructed by the rule of thumb, as it is termed—that is, by knowledge gained from a repeated series of trials and errors, and not on any fixed scientific principles. It had been ascertained in previous investigations, that the action of a solid on the water is very different from the action of fluid when impinging on a solid. These actions had formerly been considered the same. The solid causes an elevation; the elevation puts the water in motion. Thus, the question of resistance resolves itself into that of the motion of waves. Waves are of various kinds. The laws of the great primary wave had been laid down in previous communications. Its velocity depends simply on the depth of the fluid. The old law of resistance, as the square of the velocity, is too small so long as the velocity of the solid is less than that of the wave, but too great so soon as the velocity of the solid becomes greater than that of the wave.—Mr. Russell then detailed some experiments which had led to the above law, and from which it appeared that the form of the vessel of least resistance depends as well on the velocity with which it is to move as on the velocity of the wave; also, that the form which is best for moving with a velocity less than the velocity of the wave, may be worst for moving with a velocity greater than that of the wave. The consideration of the laws of this wave reconcile many of the discrepancies in experiments on this subject. Mr. Russell then proceeded to describe some remarkable facts, which they had observed on the motion of the particles constituting this wave; the particles had a vertical and a horizontal motion, and the extent of the motion depended on the force of the wave. Another remarkable result is, that the ordinates of the vessel should correspond with the ordinates of the wave: a form so constructed would separate the water without any apparent elevation or white ripple, which was common to all other forms. The form is that which belongs to the wave, which is to move with the particular velocity of the vessel.

The accompanying diagrams will serve to convey a more distinct idea of the nature of the motion of the particles of the water.

Fig. 1.

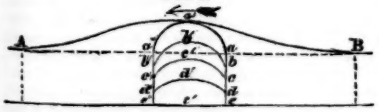


Fig. 2.

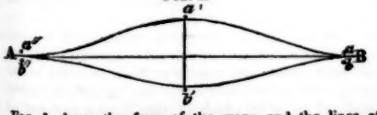


Fig. 1 shows the form of the wave, and the lines of translation of the particles during the transit; A a′ B the line of the wave; a a′ a″, b b′ b″, c c′ c″, &c. lines of translation of the particles during the transit.

Fig. 2 shows how the lines of a vessel are to be formed so as to produce a displacement analogous to the displacement of the wave, and so move though the fluid with the least resistance.

'On the Principles of Oblique Bridges,' by P. Nicholson.

The oblique arch, an invention of comparatively recent date, has been rendered necessary by the general adoption of railways, and by the necessity which exists for their being carried forward in lines as direct as possible. The theory of this arch is attended with some difficulty, and the author lays down in this paper the principle by which the engineer should be guided. Five of the faces of each stone are to be prepared in such a manner that four of them recede from the fifth, and when the stones are arranged in courses, the surfaces of the fifth face form one continued cylindric surface, which is the intrados, and the other four faces form the beds and ends of the stones in which they join each other. In every course two of the opposite courses of the first stone, two of the opposite surfaces of the second stone, and so on, form two continued surfaces throughout the whole length of each course, and the edge of each of these continued surfaces in the intrados will be a spiral line. If a straight line be drawn through any point in one of the spiral lines perpendicular to the axis of the cylinder, the straight line will coincide with that continued surface which is a bed of that course, and the straight line thus drawn will be a tangent to the curved surface of the cylinder at that point in the spiral line; the straight line then drawn will be perpendicular to another straight line, which is a tangent to the spiral line at that point. The intrados being developed, the spiral lines which form the edges of the courses will be parallel and their distances equal, and the spiral lines which are the edges of the ends of the stones will be developed in straight lines perpendicular to those lines which are the developements of the spirals of the edges of the courses. From these principles a simple geometrical construction may be deduced, such as the workman can readily use. To construct an arch on the above principle it is only necessary to know the angle of obliquity of the acute angled pier, the width of the arch within its abutments, the height of the intrados above the level of the springing, the perpendicular distance between the planes and the two faces, and the number of arch stones in each elevation. The author then detailed some examples illustrative of this method.

'Remarks on the Material and Mechanical construction of Steam Boilers,' by W. Greener.

Mr. Greener is of opinion that the accidents which happen to steam boilers are principally due to defect in the material of which they are constructed; and he details several experiments made on slips of iron cut from plates of different quality. He found that slips cut latitudinally from a plate bore less by 30 per cent. than slips of the same dimensions cut longitudinally; in some cases the difference was much greater. He also had immersed plates in a mixture of sulphuric acid and water, and found that the injury done in twenty-four hours varied from 6½ to 15 per cent. of the original strength. Many boilers will stand so long as the form remains perfect; but should any part, as the crown of the arch, in cylindrical boilers, collapse, an accident is inevitable.

A communication was also read from Mr. Maule, 'On a Substitute for the Forcing Pump in supplying Steam Boilers, &c.' It was a hollow cock having an orifice, which, being uppermost, the plug became filled with the liquid, and then, being turned half round by the motion of the piston, the liquid could run into the vessel below.

Sir John Robison also explained a model of the bucket of a pump in use in Sweden, the peculiar feature of which was, that the pressure of the sides of the bucket outwards against the pipe is exactly proportional to the load to be raised. This bucket is peculiarly applicable for raising foul water.

GENERAL MEETING, MONDAY EVENING.

The general meeting assembled in the Central Exchange. There were more than 3200 persons present. At eight o'clock the chair was taken by Professor Whewell, who addressed the meeting as follows:—

In the absence of the President of the body, the Earl of Burlington, who is now abroad, it falls to my lot to announce that to-day the eighth session is opened, of the British Association for the Advancement of Science. I make this announcement with great pleasure, having, in my recollection, the very admirable results, in the way both of advantage and of gratification, which have proceeded from former meetings. Those who have been present at them, and have attended in detail to their proceedings, as I have had the opportunity of doing, will know, that the advantages have been of no common kind. Discoveries in science, and inventions in art, have been brought forward and discussed by such men as rarely meet at any other time. Men from various parts of the world have been brought together, and of various characters—men of theory and men of practice—from the metropolis and from the provinces, to their mutual instruction and satisfaction. Considerable scientific works have been undertaken and executed; and in many ways this Association has operated to the furtherance of its object,—the advancement of science, and the intercourse, union, and efficiency of scientific men. To announce that another session of this body has opened, is, therefore, a gracious and a welcome task, and the words are, I trust, grateful to you to hear as they are to me to utter. My principal, or indeed my only business in this chair, is to resign it to the distinguished nobleman who now becomes your President. But, in doing this, perhaps you will allow me to offer one or two remarks, which shall occupy but a short portion of your time, and will be, I hope, not foreign to your purpose. I have attended every meeting of this body except one, from which I was unavoidably detained, and have filled almost every office in it, many of them repeatedly: I have, therefore, had at least the opportunity of observing its character and working. I am not going to enlarge on the services which the Institution has rendered to science; but I may, perhaps, be allowed to notice, as a signal example of its success, one subject to which it has specially directed the attention of its members, and of which I have peculiarly the means of speaking with precision. I mean the tides. The Association from the first called attention to this branch of science, which at that time was much behind other departments of knowledge. Not a meeting has passed without some advance in it being announced to the Association. The difficulties of the subject have been overcome; their complex and apparently irregular phenomena have been reduced to rule, almost with as much precision as the commonly observed phenomena of astronomy; and our knowledge of the laws of the tides is approaching fast to that condition which will enable us to see in them, as in all the great phenomena of the universe, an exact exemplification of the law of universal gravitation. This is one instance of the progress of knowledge under the influence of the Association. I could easily mention others; but I pass on to another remark. It has often been apprehended by persons, well meaning no doubt, but ill informed respecting the nature and influence of knowledge, that these advances in science would make men inert, confident, and proud, as if they had, at least on some subjects, got rid of doubt and ignorance altogether. I need not tell you, gentlemen, how far removed this inertness, this pride, this confidence, are from the true temper of science, from the train of thought which her successes inspire in those who really master them. The establishment of any truth, of any theory, is so far from leading to inaction or contemptuous self-complacency, that it imposes upon us more imperatively the necessity of labour and observation. We must examine all the facts which present themselves, and especially those which appear to be opposed to the opinions we have adopted. The doctrine of universal gravitation has long been accepted by all of us; but does that make us careless, or backward in the examination of new facts? Does it not, on the contrary, make us seek, with peculiar interest and zeal, any facts, such as those of the tides, which have not been fully reconciled with the theory? Those persons who think that this great theory is now certain, are exactly such as are most busy with those labours, which would prove it false if proof were possible. In like manner, if there be any other great theory, as, for example, the undulatory theory of light, now generally accepted, does any one suppose that on that account the ardour of our experimental optical researches, or the interest with which we shall examine and calculate the results, will be enfeebled? A person who entertains such expectations, must have a view of the nature of the progress

of science, unphilosophical in itself, and contradicted by the whole course of facts. The more this great theory of undulation approaches to certainty, the more are we bound to examine, with the most scrupulous care, all apparent instances of discrepancy; and this is in reality what the maintainers of the undulatory theory, like all other true philosophers, have done and are doing. The meetings of this Association have promoted this philosophical spirit by the discussions which have taken place in the Sections: and, on this account, I may perhaps be allowed to observe, as an old officer of the body, that it is desirable all written communications to the Sections should be brief, in order to have the more time for conversational expositions of the views of eminent men, which no written communication can explain. That the Association leads to this intercourse of men of great intellect and great knowledge, is an inestimable advantage in its constitution; and, as many of you are aware, it has repeatedly been said by the cultivators of geology and other sciences, who have assembled at our meetings, that they had made more progress in understanding each other, and placing their subject upon an intelligible footing, during the week of this ceremony, than they could have done in years in any other manner. But there is another reason, of a very different kind, which makes me look with peculiar pleasure on these assemblages. I am sure, gentlemen, many of you must have remarked the tone of reverential seriousness which has from time to time breathed through our crowded meetings. The vulgar notion of considering men of science as unfriendly to religion, is, I suppose, too absurd and foolish to be entertained by any one here. But it is not merely that nothing has ever been heard in our halls to countenance, in the smallest degree, this idle and ignorant prejudice: many of you must have been struck with manifestations of a very different kind. There has not, I think, been any annual meeting, in which there have not been introduced, by persons who addressed you, reflections which showed that the study of the universe leads us up to the recognition of its Creator. We have over and over again been reminded that we must examine nature's works with a profound reverence for Him who is the Author of nature, and read his laws as his will; and it has been declared, that the study of natural laws does bring with it this reverential regard towards him who is our Maker and Master. This has been repeatedly said,—and that not formally, in virtue of previous preparation and arrangement,—but such reflections have burst forth spontaneously, and, as it seemed, inevitably. They have proceeded, too, not from persons who, like myself, might seem to be directed by profession and habit to such thoughts, but from unprofessional persons, senators, men of general literature, and men of the world, in the best sense of the phrase. Such persons, as you msut have noticed, have repeatedly shown us how in their minds the vast scheme of law, and order, and beauty to which science introduces us, only lifts our thoughts towards that great Being in whom are the fountains of law and order, and who makes the earth his footstool, and the heavens his temple. The cause in which we are engaged is not only blameless and good, but sacred and holy: so far are we removed from having to apprehend any want of respect to religion being the consequence of the employments on which we are now entering. I will, before I quit this chair, mention one other consideration, which makes me welcome, with peculiar pleasure, the recurrence of these meetings. The kind and cordial hospitality which has welcomed us wherever we have gone, has been such as gave an additional charm to our scientific pursuits. We have been every year received as friends and brothers,—admitted to the tables and the domestic circles of those whose cities we have visited, and treated as if the objects which we have in view gave us an entire claim to the confidence and good will of those among whom we came. For my own part, I have never visited any place on these occasions, without forming, I do not merely say acquaintance, but friendship—connexions with persons from whose society I have derived continued pleasure, and with whom, I hope, my intercourse will subsist during the remaining years of my life. In the good-will and hospitality with which the members of the Association are received, I am sure there is no abatement on the present occasion. And in that, and in all other ways, we enter, I doubt not, upon a meeting inferior to no preceding one in the advantageous and agreeable character of its proceedings.

It is now my grateful duty to resign this chair to the distinguished nobleman who is your President. It is not for me to presume to praise him; but this I may say, that I know him to be most worthy to fill this place, as a generous and enlightened patron of science. I know this, not only from common report, by which all of you know it; but I know also, that, in my own university, he has built a new portion of the observatory, and provided it with one of the finest telescopes ever constructed; and that he has displayed his love of the same science in another way,—having requested to co-operate, by his munificence, in the greatest astronomical undertaking of modern times, the labours of Sir John Herschel. I now resign to your Grace the chair of President of the British Association, wishing your Grace happiness in the discharge of your duties, and placing my own services at your disposal.

The Duke of Northumberland, on taking the chair, expressed his gratitude for the honour that had been done him, and for the warmth with which he had been received. Such meetings as that over which he had been called to preside, were of national importance; they developed the intellectual resources of the country within, and raised its character abroad. The Association encouraged the fullest discussion of scientific truths, but it did not hold itself responsible for any of the theories enunciated by its members. His Grace then announced the arrangements for the ensuing week, and called upon the Treasurer to read his Report.

Mr. John Taylor then gave an account of the financial state of the Society, which may be best collected from the following table:—

Receipts and Expenditure from 31st July, 1837, to 31st July, 1838.

RECEIPTS.

	£.	s.	d.
Balance in hand from last account	248	0	6
Compositions from 318 Members..£1538	0	0	
Subscriptions, 1837..1350 Members, 1350	1	0	
Ditto 1838.. 29 — 29	0	0	
Arrears .. 1836.. 24 — 24	0	0	
	2941	1	0
Dividend on 4500*l.* in 3 per cent. Consols, 6 months, to Jan. last.. 67	10	0	
Ditto, 5500*l.* 6 months, to July 82	10	0	
	150	0	0
Received on account sale of Reports, Vol. I. 2nd edition 47	3	0	
Ditto Vol. II. 40	8	0	
Ditto Vol. III. 66	16	0	
Ditto Vol. IV. 85	11	0	
Ditto Vol. V. 181	9	0	
Ditto Lithographs 1	1	9	
	422	8	9
	£3761	10	3

PAYMENTS.

	£.	s.	d.
Expenses of Meeting at Liverpool	279	6	0
Disbursements by Local Treasurers	151	18	10
Purchase of 1000*l.* in 3 per cent. Consols	910	0	0
Salaries to Assistant Secretary and Accountant 18 Months, to Midsummer last	375	0	0
Grants for Scientific purposes, viz.:			
Committee for Discussion of Tides, grant 1836	29	0	0
Ditto ditto at Bristol	50	0	0
Ditto, Meteorology and Subterranean Temperature, grant 1836	8	6	0
Ditto ditto 1837..	23	3	5
Ditto, Experiments on the Heart 1836	5	3	0
Ditto, Land and Sea Level	228	7	1
Ditto ditto, Instruments 1837	39	1	6
Ditto, on Education	50	0	0
Ditto, Growth of Plants under Glass 1836	25	0	0
Ditto ditto 1837..	50	0	0
Ditto, Experiments on Mud in Rivers	3	6	6
Ditto, Fossil Ichthyology	100	0	0
Ditto, Experiments on Strength of Cast-iron	60	0	0
Ditto, Animal and Vegetable Substances Preservation	19	1	10
Ditto, Railway Constants	41	12	10
Ditto, Duty of Engines in Steam Vessels	100	0	0
Ditto, Meteorological Observations at Plymouth	50	0	0
Ditto, Construction of Anemometer	40	0	0
Ditto, Repairs of ditto	10	0	0
	932	2	2
Paid for Printing Reports, Fifth Volume	418	13	1
Sundry Expenses publishing Reports	10	16	7
Sundry Printing	13	13	0
Balance in the hands of the Bankers, £543 17 11			
Ditto ditto Treasurer 84 6 4			
Ditto ditto Local Treasurers, 41 16 4			
	670	0	7
	£3761	10	3

Property of the Association, 31st July, 1838.

	£.	s.	d.
Cash in hand	670	0	7
5500*l.* in 3 per Cent. Consols (in the names of Charles Babbage, R. I. Murchison, and John Taylor,) valued at 93¼	5142	10	0
Books	1000	7	6
	£6812	18	1

Mr. Murchison, the General Secretary, then read the following—

REPORT.

Gentlemen,—At the conclusion of the first Septenary which has elapsed since the establishment of the British Association, the Council have deemed it expedient to direct us to prepare a general and comprehensive view of its past progress and future prospects. In virtue, therefore, of the commission thus intrusted to us, we shall endeavour to perform a task which we cannot approach without a feeling of apprehension and anxiety, impressed as we are with the difficulty of duly appreciating the prominent labours of our associates, and of estimating their hearing and probable influence on the advancement of science. The space of time, however, which is allotted to this address, will not allow us to attempt an analysis of all the past proceedings of the Association. We are, therefore, compelled to confine ourselves to a few allusions to the reports of former meetings, (dwelling more particularly on the last,) and to a statement of the great principles which form the basis of our constitution, and which have directed and regulated its practical operations. And, if in thus stating the aims of the Association and the principles on which it proceeds, we should be guilty of repeating some things which have been better said before, we trust it will be borne in mind, that from the migratory character of our meetings, and the change which that character implies in the body of members present at each, a probability arises, that those principles may not be sufficiently understood, if they are not from time to time re-stated and re-explained.

It would be superfluous for us to speak of those objects of the Association, which are the most obvious, and which undoubtedly constitute the highest enjoyment these meetings afford us—the union of congenial minds—the mutual communication, without let or hindrance, of the knowledge we have acquired in our respective pursuits—the scintillations of new ideas struck out in private conversation and public discussion.—"This feast of reason and this flow of soul," agreeable and instructive as it is, requires no comment; and though it contributes

most essentially to all the purposes for which we are assembled, and gives life to all our proceedings, it is however on no account to be regarded as the chief aim and business of our meetings. That which has, from the first, gentlemen, been laid down as the highest object for which we meet, is to supply the great defect under which science has formerly laboured, of depending solely on individual and insulated efforts, by combining its cultivators into a body politic, calculated to give force and consistence to those efforts, and exercise a powerful influence both on its own members and on the public mind; thus marshalling a scattered militia into an organized and effective army, and converting desultory incursions into a regular and progressive march. The want of some such public authority in matters of science as belongs to an union like the present, could not be more strikingly shown than by the service which, on two occasions, the British Association has rendered to astronomy, in obtaining from government the means of effecting the laborious and expensive reductions of the observations—first, of the planets, and lastly, of the moon, which had been made by Bradley, Maskelyne, and Pond. The existence and liberal support of the noble establishment, at which these observations were made, bore evidence that our rulers have not been insensible to the immense importance of astronomical inquiries to a great maritime nation: but that so much of the precious ore which had been accumulated during the greater part of a century, by the successive labours of the greatest practical astronomers of any age or nation, should have remained unwrought and nearly useless for the highest applications of science, amidst the vain and oft-repeated regrets of those who were the most competent judges of its value; what does this prove, but that there were no councillors of sufficient weight, number, or influence, not only to offer advice to the government, but also to secure attention to it when offered?

In whatever degree the practical value of science may be beginning to be understood and appreciated among us, business of more proximate interest and more obvious urgency engrosses the attention of our public functionaries and legislators: numerous projects are presented to them rarely reduced to a practical form, among which they know not how to distinguish which *are*, and which *are not* deserving of national encouragement; and the consequence has been, with few exceptions, the general discouragement of all—a consequence neither conducive to the reputation, nor serviceable to the interests of so great a country. But a representation on subjects of science proceeding from such an Association as this bears a public character, and carries with it a degree of weight which does not, and ought not, to attach to individual applications; and as long as the same judgment and forbearance which have hitherto characterized its course in this respect shall continue to be exercised,—as long as special care is taken to ask nothing of government, but *what it belongs to the national interests, or honour, to effect*, and *what cannot be effected but by national means*—so long doubtless that attention will be paid to our recommendations, which they have already begun to receive. Wisely cautious and reserved in exerting its influence, the Association has hitherto made but few applications to the government. Besides those to which we have before referred, and which were immediately complied with, another was made regarding the slow progress of the trigonometrical surveys of England and Scotland; the latter probably owes its recent acceleration to the attention thus first drawn to the subject, subsequently reinforced by a deputation from the Royal Society of Scotland; but the survey of England, which, having commenced nearly half a century ago, has not yet reached the Trent, is still in abeyance; and these northern districts in which we are assembled, and which comprise so large a part of the staple riches of the country, continue without their due share of the advantages which would attend its execution. There have been likewise two other national objects on which the Association has expressed its opinion; the one being the establishment of a magnetical observatory in Great Britain, the other an expedition for the purpose of making magnetical observations in the Antarctic seas. For the attainment of the former of these objects no interference was found necessary, an arrangement every way satisfactory being determined upon for connecting it with the Royal Observatory at Greenwich, on the recommendation of the Board of Visitors. The publication in the present volume of our Transactions of an elaborate report on the variations of the magnetic intensity of the earth, (unquestionably one of the most valuable which has hitherto appeared in them, whether we consider the laborious reductions it has required, or the important conclusions to which they lead,) recals our attention to the latter point. The subject is one of such deep interest, that we hope we shall not be thought to trespass too much on the time of the meeting, if we repeat some of Major Sabine's remarks upon it in his own words:—

"I have already adverted to what the influence of the Association may effect, in causing the spaces yet vacant on the map, in the British possessions in India and Canada, to be filled. But beyond all comparison, the most important service of this kind, which this or any other country could render to this branch of science, would be by filling the void still existing in the southern hemisphere, and particularly in the vicinity of those parts of that hemisphere which are of principal magnetic interest. This can only be accomplished by a naval voyage; for which it is natural that other countries should look to England. That the nations that have made exertions in the same cause do look to England for it, cannot be better shown than by the following extract of a letter of M. Hansteen's, which I take the liberty of introducing here, both for this purpose, and because it expresses in so pleasing a manner, the praise that is so justly due to his own country, and which I am sure will be cordially responded to by all who cultivate science in this country, and particularly by those who know the kindly feeling with which Englishmen are ever welcomed in Norway.

"C'est le Storthing (la Chambre des Députés) de la Norvége, qui a donné les frais à l'expédition en Sibérie. On a fait cela dans un tems où on a refusé les dépenses pour un château de résidence pour sa Majesté à Christiania. Dans un tems, où une telle économie a été nécessaire, il est très honorable, qu'une Chambre, composée de toutes les classes du peuple, même d'un grand nombre de paysans, a *unanimement* résolu de donner les frais pour une expédition purement scientifique, dont les résultats n'auront jamais aucune utilité économique pour la patrie, et dont on ne comprenait pas la haute valeur scientifique. Regardé les ressources très-bornés de notre pays, c'est une générosité presque sans exemple.

"Comme la petite Norvége a fourni toutes les observations entre les méridiens de Greenwich et de Ochozk, et entre les parallèles de 40° et 75° de latitude boréale, il ne me semble pas une demande trop grande ou immodeste à l'Angleterre, si grande, si riche, si puissante, qui a nécessairement un plus grand intérêt dans toutes les sciences combinées avec la navigation, de fournir toute la partie méridionale de la carte. Une telle entreprise doit réfléchir une splendeur à la nation, et payera à la fin les frais par des résultats aussi utiles pour les sciences que pour la navigation. Il ne faut plus dans notre tems laisser l'avancement des sciences au hasard. Par des observations fragmentaires et discontinués on a tâché avec grande peine d'étudier les phénomènes magnétiques de la terre pendant deux ou trois siècles. Par deux ou trois expéditions arrangées *exprès pour ce but*, on pourrait en peu d'années avoir une collection plus complète, et d'une plus grande utilité pour la théorie."

The subject has in every way a claim on this country. The existence of four governing centres, and the system of the phenomena in correspondence therewith, was originally a British discovery. The sagacity of our countryman Halley was the first to penetrate through the complexity of the phenomena, and to discern what is now becoming generally recognized. England was also the first country which sent an expedition expressly for magnetic observation, namely, that of Halley in 1698 and 1699. Whilst approving and cordially co-operating in magnetic inquiries of other kinds which have their origin in other countries, it is right that we should feel a peculiar interest in that in which we have ourselves led the way, especially when its object is subordinate to none. As the research would require to be prosecuted in the high latitudes, a familiarity with the navigation of such latitudes would be important in the person who should undertake this service; and a strong individual interest in the subject itself would be of course a most valuable qualification. I need scarcely say, that the country possesses a naval officer* in whom these qualifications unite in a remarkable degree with all others that are requisite; and if fitting instruments make fitting times, none surely can be better than the present. Viewed in itself and in its various relations, the magnetism of the earth cannot be counted less than one of the most important branches of the physical history of the planet we inhabit; and we may feel quite assured, that the completion of our knowledge of its distribution on the surface of the earth, would be regarded by our contemporaries and by posterity as a fitting enterprise of a maritime people; and a worthy achievement of a nation which has ever sought to rank foremost in every arduous and honourable undertaking.

The course pursued by the Association in reference to this object, is well calculated to show the system of its operations, and the active but yet unintrusive and guarded spirit in which it prosecutes its aims. It was proposed at one of our meetings, by the Committee of the Physical Section, that a representation should be made to government of the advantage which would accrue to science from an expedition to the Southern Ocean, devoted to the purpose chiefly of instituting magnetical observations. This proposal first underwent the revision of the Committee of Recommendations, and then obtained the sanction of the General Committee of scientific members; subsequent circumstances, however, being considered by the Council as unfavourable to the success of the application, it was not urged at that time upon the government, yet the object was not lost sight of. The Association next procured reports to be drawn up, (from one of which we have quoted the foregoing paragraph,) presenting a luminous exposition, both from published and unpublished sources, of the present state of our knowledge of the magnetism of the earth, and of the reasons which there are for wishing to extend to the Southern hemisphere those researches which in the Northern have led to such important conclusions; and thus has the way been prepared through information thus communicated to the public for pursuing the intended course with advantage, and making a more effectual application to the government. There may be, once in an age, or in many ages, an individual animated by so lofty an ardour for the advancement of a favourite branch of knowledge, as to engage, at his own cost, in an enterprise (like a recent survey of the southern skies) which it might have become a nation to take upon itself; and there may be an individual whose disinterested munificence may extend to the point of rendering labours of this magnitude as available to the public as if the state itself had contributed its aid; but such sacrifices to science are not only uncommon, they are in general impracticable; and there are numerous most important data and elements for philosophical reasoning, with all its train of practical utilities, which individuals cannot be expected to undertake, unless provided with pecuniary assistance. We have already said, that one of the principles on which the Association proceeds, is not to look to government for anything which can be otherwise attained; but when this Institution was established, the founders of it foresaw that it might itself be made applicable, in a great degree, to the object of supplying funds for such undertakings. The resources of other societies are employed on their publications or collections; and it is one of the rules of the German scientific "Reunions" that they shall possess no property. *Our objects* were more extensive than *theirs*, and, therefore, *our plan* was different. We have accumulated property and expended it, to give wings to investigation, partly by providing instruments and materials for carrying on certain determinate inquiries, and partly in defraying the expense of labour, especially labour of that kind, which, whilst it is of the highest value in its results, possesses no attractions in its execution, and would meet with no adequate remuneration.

The present volume of our Transactions contains many proofs of the service which the Association has rendered by such applications of its pecuniary means. In the account there rendered of the *discussion* of observations of the Tides, Mr. Lubbock (the Reporter)

* Capt. James Ross, R.N.

thus explains the manner in which the last grant of money placed at his disposal has been employed. He reports that two gentlemen had been engaged by him to discuss the observations which had been accumulated at Liverpool and the London Docks, the one series continued during nineteen years, and consisting of 13,391 observations; the other carried on for thirty-five years, and including 24,592 observations; and also to examine carefully the *establishment and average height of high water*, in order to ascertain the fluctuation to which these quantities are subject; and after bearing testimony to the pains and accuracy with which the work has been executed, and stating the conclusions which result from these laborious calculations, adds, that "they never could have been undertaken but for the interest which has been felt on the subject by some of the most distinguished members of the Association, and but for the pecuniary grants which have at different times been devoted to this object," expressing, at the same time, a well-grounded hope "that when these results (which have since been published in the Philosophical Transactions) are carefully examined, they will not be found disproportionate in value to the great labour and expense which have been required for their attainment." A service of a similar description has been rendered to astronomy in the determination, by Dr. Robinson, of the disputed *Constant of Nutation* from the Greenwich Observations. Of this work, which involves much labour of reduction, and which, to use the words of the eminent astronomer who executed it, the powerful aid of the Association has enabled him to perform, a brief statement only, comprising the method employed and the general results, is given in our Transactions, the fuller details requiring, as the author mentions, a different mode of publication. And this, Gentlemen, leads us to remark how unfounded were the apprehensions of those who feared that this Institution would divert the springs from which other societies are supplied, whereas the instances before us prove that their Transactions have been enriched instead of being Impoverished by our operations. There is a further remark which we are prompted to make on the work accomplished under Mr. Lubbock's superintendence by a reference which his report contains, to a subject of great interest to the science of geology. "I conceive (he says) that the best, if not the only method of investigating alterations in the height of the land above the water, in any given locality where the water is influenced by the tides, will be to examine carefully whether any alteration has taken place in the value of the (tide) constants D. and E. for that place, the height of high water being, of course, always reckoned from some fixed mark in the land." The meeting will here perceive one of those connexions between departments of inquiry apparently remote, which show how much each is concerned in the advancement of another, and ought to prevent any jealousy respecting the distribution and allotment of our funds. There is, indeed, no part of the proceedings of the Association which requires to be regarded with more care than the disposal of its grants, and our constitution has been framed with a particular regard to this point. In the first place, every section of science has its own committee, from whose deliberations every proposal of a grant must emanate. Secondly, these proposals are all submitted to a central Committee, which recommends such of them as it deems unobjectionable to the general Committee for final adoption or rejection. By these means the best provision has been made for preserving the administration of our pecuniary resources pure, judicious, and consistent. So far as any rule of allotment has been followed, it seems to have been only to assign the largest grants to the most determinate, and at the same time expensive investigations; but the Association has not deemed it expedient to restrict itself to these. Whenever the Committee of any Section has been desirous of confiding any inquiry involving an outlay of money to a competent person, the Committees of revision and approval have always been anxious to comply with the recommendation. The meeting will observe with satisfaction that the first step towards the solution of the geological question alluded to by Mr. Lubbock, has been taken under the superintendence of the committee appointed for the purpose. Mr. Whewell, to whose more special superintendence the conduct of this work was intrusted, reports that a line has been levelled by Mr. Bunt from Bridgewater to Axmouth, to be thence continued to the Bristol Channel; and such marks have been left as will allow of repeating or extending the levels, and comparing at a future period the height of the several fixed points.

We are thus led to say a few words about Geology, a science which is rapidly advancing to take its permanent station among the more accurate natural sciences. It is now six years since Mr. Conybeare laid before us his eloquent general view of its then existing state; but the lapse of a much shorter period in a science which is making such vigorous shoots, would present sufficient materials for a report which should enumerate and define the latest conquests it has achieved. The fact is, that the very literature of this subject is so vast, that none but the most practised and laborious geologists can keep pace with its progress; and though the anniversary discourses of the successive Presidents of the Geological Society generally contain a sketch of the works and memoirs which have appeared in the course of the preceding year, still we are convinced, that a condensed retrospect of the progress of geology, which should embrace a somewhat larger period and a wider range, executed from time to time at the request of the Association, would not only be grateful to geologists, but would also tend to combine the discoveries and promote the advancement of this science. But besides general reports on geology, this Association will, it is hoped, encourage a continued attention to the consideration of mineral veins, since there is no branch of geology of such direct public interest as the results of the miner's discoveries. In a clear and instructive Report formerly read by our Treasurer, Mr. John Taylor (himself a most experienced and able miner), he expressed a wish, which we trust to see accomplished, that miners would hereafter not rest satisfied with such observations and knowledge as the mere practice of their art required, but would extend and combine their inquiries in such manner, as to make them the foundation of more general and comprehensive views, and would tend to connect more intimately than heretofore, the science of geology with practical mining. This subject, so important in its bearing upon the production of our mineral wealth, cannot be too strongly recommended to the attention of the Geological and Mechanical Sections of the Association. We venture, indeed, to hope that the Newcastle meeting will be pre-eminently marked by the diffusion of much sound mining knowledge, flowing as it must, from the meeting together of the most experienced Cornish miners with those of Durham and Northumberland. We are further encouraged to indulge in this expectation from knowing that this meeting is honoured by the presence of an Austrian nobleman, long valued by English geologists, and whose thorough acquaintance with mineral veins, and all their complicated *faults* and changes well entitle him to occupy the high station confided to him by his sovereign.* And here we cannot but observe, that as, with all its mineral wealth, Great Britain is the only country in Europe without a national school of mines—so much the stronger is the call upon the British Association to promote the analysis of every natural phenomenon and useful invention connected with the art of mining. But while we make this appeal, we cannot assemble in this neighbourhood without congratulating the University of Durham, on having led the way to the establishment of a school of mines and engineering, in which the principles and knowledge of this branch of science are regularly taught; and we further feel gratified, that so important a charge has been intrusted to men distinguished for their scientific attainments, including in their numbers one of the earliest promoters of the British Association, and one of its local Secretaries at this meeting.†

In the arrangements of the Association the sciences of Mineralogy and Chemistry have been united. Such an union may be justified, not merely by its convenience in the distribution of our labours, but by the close alliance which subsists between those sciences, in all that concerns the connexion of chemical composition with crystalline forms, presenting so many remarkable relations of very recent discovery, and leading so rapidly, as Mr. Whewell has, on more than one occasion, so clearly shown, to enlarged views of the true principles of mineralogical classification. But whilst we fully recognize the connecting links which unite those sciences, we trust that this partial and temporary separation, which the active and somewhat absorbing study of palæontology has almost necessarily occasioned, will not be of long continuance, and that the laws of crystallization, which constitute its alliance with another science, will in the progress of our knowledge give as much importance to its connexion with the study of the crystalline structure of vast masses of the surface of the globe, as in the most searching analysis of its minutest particles. Let not, however, the exclusive advocates of any one theory of the proper relation of those sciences, induce us to abandon inquiries so pregnant with remarkable conclusions, and which truly constitute the great basis and framework of modern geology: for the more minute and laborious our investigations, the more certainly do we make out that many rocks which were once supposed to be made up of inorganic matter, are in truth composed of animal remains. And do we not look for the presence among us of a distinguished philosopher of Berlin, who, above all others has eliminated this discovery, and who, by the powers of the microscope, has revealed to us the skeletons of millions of once living and perfect animalcules inclosed in a single cubic inch of solid stone! Well, indeed may we quote the recent work of Lyell, who, rejoicing in this great discovery, exclaims with the poet,—

The dust we tread upon was once alive.

In noticing the labours of the section of Geology and Geography, we have to observe, with regret, that the latter science has not hitherto received at our meetings that amount of attention to which it is justly entitled. When we consider the advances which the science has recently made under the auspices of the Royal Geographical Society of London, we cannot but lament that the British Association did not, at an earlier period, request a report from some one of its members upon the present state of our geographical knowledge, and upon those departments of it in which our researches might be most advantageously prosecuted. The annual reports of the Secretary of the Geographical Society,—particularly the last report of Capt. Washington, and the admirable discourse recently delivered by its President, Mr. W. R. Hamilton, have in great measure supplied this deficiency, making the public acquainted both with much that has been done, and much that remains to be worked out in this very important branch of knowledge. But though we have thus been partially anticipated, we feel satisfied that such a report, by bringing into prominent notice, before the whole body of the Association, a statement of those great geographical problems, whose solution is most specially desired or most easily effected, may serve to secure for the promotion of geography the application of some portion of those funds which have been hitherto exclusively appropriated to other sciences.

The merits of the Statistical Section have been already made manifest, by the collection of a great variety of very important data. On this occasion, we have to notice a very perspicuous and well arranged report, which appears in our Transactions, upon the statistics of a large province of Hindostan, which sufficiently proves that a statist, who would really contribute to the advancement of statistical science by collecting facts in distant regions, must possess no slight qualifications. In vain, in the absence of other essential branches of knowledge, may he accumulate half-digested and ill-assorted observations, he must also combine, as in the person of Col. Sykes, the acquirements of the naturalist and geologist with those of an accomplished soldier and of a man of general information.

The accumulation of such facts is obviously a very fit part of the labours of this Association, for they prove statistics to be truly a science of method. This science occupies the same relation to political economy in its most comprehensive sense, which astronomical observations held relatively to astronomy, before the discoveries of mechanical philosophy enabled recent philosophers to make those early observations perform a mighty part in testifying the great primal truths of physical philosophy, and applying them to

* Count Breunner, Director of the Imperial Mines, Foreign Member of the Geological Society.

† Professor Johnston.

explain, and even to predict, the varied motions and phenomena of the earth and heavens. Such a stage there must be in every inductive science,—one in which immediate straining after comprehensive truths would be rash, while the marshalling and classing phenomena is a task full of usefulness and hope. Those only who mistake the stage of discovery in which statistical observers are now placed,—who do not see, that at present, observation without premature speculation, is the one and necessary step towards wide truths, will either be impatient to weave rash theories from our present imperfect materials, or to scoff at the unscientific character of those who labour patiently to increase and arrange them. The analogy between the early stages of astronomy and the actual position of statistics might be made more complete. The *secular* character of many classes of statistical observations necessary to elucidate difficulties and disentangle truth, might be easily demonstrated, but enough has been said for the purpose of indicating the really scientific character of this useful branch of our Institution.

It has fallen to our precursors to comment on the advances in natural history which have been made by the section of Zoology and Botany; and although, on this occasion, we are not presented with any report upon these sciences, you all know how ably they have been elucidated at former meetings, by a Lindley, a Jenyns, and a Richardson; and also with what vigour that Section has prosecuted its inquiries under the auspices of a Henslow and a Macleay. We must, however, here allude to the distinguished Northumbrian naturalist, who occupies one of our vice-chairs, and express our hopes that Mr. Prideaux Selby may soon be called upon to contribute what is yet a desideratum—a report upon the present state of the science of Ornithology.

We have hardly ventured to allude to the separate proceedings of the Sections, for any discourse which should attempt to analyze their labours, or to do justice to their usefulness, would occupy too large a portion of your time. And besides this consideration, you, Gentlemen, are all aware, that these Sectional Meetings give rise to the Reports we have been considering, and also to the various practical researches which are carried out by the employment of your own funds, or by demands upon the country. If, therefore, the Reports constitute our high claim upon the literature of science, the proceedings of the Sections must be viewed as the fresh current of scientific enterprise, which continually vivifies and renovates the whole body of the Association.

Among the investigations which are proceeding under the auspices of the Association, those which originated in the Committee of the Medical Section, including several subjects of physiological interest reported upon in the present volume, are remarkable for that spirit of *co-operative* labour which has not been common in this country, and which it is one of the happiest effects of these meetings to facilitate and encourage. In like manner, a question of great interest as regards one of the most important products of our mineral wealth and national industry, which had been discussed with more than common warmth and earnestness at former meetings of the Association, has been examined by an analysis, performed by one of the most distinguished chemists of the present day, of the iron produced by the application of the hot and cold blast respectively; which was undertaken at the request of the Chemical Committee, combined likewise with experiments, on an extensive scale, upon its relative strength and other properties, which were commenced at the desire of the Mechanical Section, by Messrs. Hodgkinson and Fairbairne, whose profound and extensive knowledge of practical mechanics so well qualified them for a task which they have executed with singular ability, enterprise, and skill. The experiments on waves, which are detailed in Mr. Russell's report in our present volume, were likewise undertaken at the request, and carried on by the aid of the funds of the Association. The accurate conception of a wave, its origin, propagation, and laws, is one of the most difficult and fundamental of those which are required in many of the delicate and embarrassing inquiries of natural philosophy; and the experiments of Mr. Russell are well calculated to illustrate and confirm many of the results which the mathematician has deduced from the theory of fluid motion. Adhering, therefore, to our design of mainly noticing those parts of our recent transactions which illustrate the prominent points in our system of operations, we shall conclude our remarks by noticing a report by Prof. Johnston, on a new and curious subject of chemical inquiry, as affording a good example of the execution of an object which the Association has had much in view. The discovery that there exist definite chemical substances, which are capable, under certain conditions, of assuming more than one crystalline form, not deducible from nor referable to each other, and accompanied with different physical properties; and furthermore, that there are instances of substances which are capable (independently of any change of composition) of undergoing some internal transmutation sufficient to vary even their chemical affinities: these are discoveries which, pointing out a new road to the investigation of the hidden mysteries of molecular attractions, peculiarly deserve to be verified and extended. But it so happens, that they have been little studied or prosecuted in our country; and, therefore, the Chemical Committee, in accordance with one of the prominent designs of the Association, selected this particular point as the subject of the Report on Dimorphism, printed in this volume, which gives a fuller statement than we before possessed, of the facts arrived at by foreign experimenters, the reasonings founded upon them, and the questions which are left for future inquirers to solve. This is the precise point at which the Association aims in the reports on the state of our knowledge, which occupy the chief space in its publications; they are not intended, like the articles in an Encyclopædia, to *teach and diffuse* science, but to *advance* it,—to show what *has been* done with a specific view to what there *remains to do* —to look forward to conquests to come, rather than backward on those which are past—to survey the border territory, and reconnoitre the *debateable* land. We have in this, as in other respects, followed in the steps of him who gave the original sketch of an Institution like the present. The great teacher of inductive science and experimental philosophy, who first showed the importance of knowing the lines which divide knowledge from ignorance, and in the memorable list of DESIDERATA which he drew up, did more for "the progression of the sciences" than would have been done by any discoveries he could have made.

Having thus endeavoured to elucidate, by reference to some portions of its recent transactions, the comprehensive system of this Association, and to mark the real value of its corporate influence, its pecuniary resources, and its concentrated intelligence, I would lastly notice that part of the system which has given occasion to our present muster in this prosperous and splendid city—the migratory character of our meetings. In these migrations there is a double advantage; the Association gains much by them, and perhaps the places it visits do not gain less; for its visits may sometimes have the effect of drawing genius from obscurity, and giving an impulse to powers which might never have been exerted, and a direction to labours which might otherwise have been misapplied. To our own body two great advantages are derived: one is, that the wave, in rolling along, gathers to it all the scattered science of the land, and that a more general and powerful union is thus formed than could ever be collected by an Institution resting on a fixed point: the second is, that varied objects of interest, and different opportunities of utility, are offered by circumstances proper to the different places which the Association visits; thus the lofty tower of York furnished means for the best experiments that have been made on the phenomena of rain; Liverpool contributed its contingent to our knowledge of the tides; whilst Bristol carried a line from sea to sea, to ascertain the permanence or the mutations of the level of the land and water. And does not this city and vicinity, Gentlemen, also present its own peculiar objects of speculation, and opportunities of research? Is not the optical philosopher interested in its celebrated glass-works? Can the chemist contemplate with indifference those conspicuous and truly magnificent establishments which exhibit, on so grand a scale, the application of those processes, which have been deduced and perfected in his laboratory, to productions so important in our manufactures and arts?—or can the geological or physical inquirer stand near its mines—those vast store-houses of nature for the uses of art, the theatre of the most beautiful of all the applications of science to the purposes of humanity, without having his curiosity awakened; or contemplate those deep excavations, the most accessible of any that have been carried into the bowels of the earth, without being tempted to investigations which may lead perhaps to a better understanding of the internal condition and structure of our globe? Or can we survey the architectural creations which surround us in the place in which we are assembled, where order and magnificence have replaced confusion and meanness, with a rapidity more resembling the illusions of an Arabian tale, than the sober anticipations of experience, without being encouraged in our own efforts by witnessing such noble results of *individual* enterprise, genius, and arrangement which have associated the triumphs of art with those of manufactures and commerce, and combined the refinements of wealth with the most varied productions of industry?

> Hic portus alii effodiunt: hic alta theatris
> Fundamenta locant alii, immanesque columnas
> Rupibus excidunt, scenis decora alta futuris.

Finally, Gentlemen, there is another reason for these migrations, which it would be highly ungrateful in us to overlook, which is equally felt by the Association and by the place which it visits—the warmth of hospitality which we see these visits call forth, the union of hearts and the excitement of kind and friendly feeling acting on all our objects, like oil on the wheels of a vast and powerful machine, without which its every movement would be retarded, and its whole power brought to a stand. Never, indeed, can the vitality of this Association be impaired, so long as the leaders who have borne the bark of science along the waves shall lay stoutly to their oars. Assembling for a common cause, and confiding in each other, may they ever glory in having knit together all classes in the love of science; and whether presided over, as on this occasion, by a noble duke, alike illustrious for his just appreciation and generous encouragement of our pursuits, or in the ensuing year by some one eminent in their cultivation, we shall, we trust, go on waxing in strength, and holding out the cheering example of a great and triumphant commonwealth of science.

The Meeting broke up early, to allow the members an opportunity of attending the ball given by the Mayoress.

TUESDAY, AUGUST 21.

SECTION C.—GEOLOGY AND GEOGRAPHY.

The first paper read was a continuation of Mr. Buddle's account of the Newcastle coalfield. He stated, that the great length of the paper, and the limited time of the Section, would oblige him to give an extremely short abstract. He then adverted to the foreign substances interstratified with the coal: these are shale, galena, fire clay, calcareous spar, iron pyrites, quartz, sand, and ironstone. The earthy strata among the coal are called bands. Numerous bands occur; but the most remarkable seems to be the Eworth band, which at first is a mere parting, but at last, in its range N.E., swells out into a thickness of eighteen fathoms. The most common foreign substance is perhaps pyrites, which occurs in disseminated cubes, and also in thin veins. Calcareous spar is found on the facings of the seams, between the constituent laminæ. Balks, nips, and hitches, the various kinds of roof, accidental circumstances affecting the quality of the coal, were then noticed; and some singular groups of trees in an upright and inclined position, described. The author then pointed out, by means of numerous sections, the various coal seams,—of these there are five, the High Main seam, the Two Yard coal, the Belcham coal, the High Quarter coal, and the Hutton seam on the Wear. The High Main seam is by far the most important. In Sheriff's Hill, the seams are aggregately richer than in any other place; though there are several places where they are richer individually. The area occupied by the most perfectly developed part of the High Main seam, is about eight or nine square miles. The four other seams were briefly noticed, and the changes which take place upon them, in their course, by the intermixture of foreign substances, whereby they are so far

deteriorated and reduced in thickness, as to be no longer worth working.—The next subject treated of was the Whin Dikes of the district; of these there are not many, and only three or four of them are large. The first is the Coaly Hill dike, which has been long known, and quarried in various places. Its course is irregular and serpentine; and it appears to have been injected among the strata in a liquid state after the coal was formed, and to have followed in its course the line of least resistance. Some of the dikes have been observed at a great depth cutting through the coal seams, and others range below all the coal strata. Their effects on the contiguous strata are to convert the coal into cinder; and one instance was mentioned, where the coal on one side of a dike was carbonized, while on the other no such change had been produced; from which it was inferred, that the coal on the one side was formed before the dike, while that on the other was of later origin.—The faults or slips were next described. By far the most remarkable of them is the great Ninety Fathom dike, which appears upon the sea shore at Cullercoats, and ranges at first west, then south-west, and again to the west. At Whitby, this fault depresses the coal to the depth of 510 feet; farther west the depression is still greater, the strata being 1200 feet lower upon the northern than upon the southern side. The smallest vertical shift seems to be 450 feet. A great many minor faults open into this great axis or line of fracture; and so numerous and vast are the dislocations and fractures which it has every where produced, that a great quantity of valuable coal has been rendered quite unfit for working. From various phenomena which are observed along the line of this fault, Mr. Buddle is of opinion, that it was formed while the strata were in a soft and yielding state, and before they had acquired that solid and rigid form, which would rather cause them to snap asunder by a great pressure downwards, than yield in the manner they have done.

Mr. Buddle's paper was illustrated in every part by a profusion of accurate and highly-finished drawings, plans, and sections.

Dr. Buckland adverted to the great value of Mr. Buddle's paper. This coalfield was unquestionably the most important in the country, since the metropolis itself, and nearly half the country, might be said to depend almost entirely on it. He thought that we could not over-estimate the importance to succeeding ages, of having a complete and accurate record thus made of all the beds of coal and the various workings,—in fact, of a perfect plan of this great subterranean region, such as Mr. Buddle had given; since it would serve as a guide in after generations for every mining enterprise, and might be the means of saving, not only much property, but even the lives of multitudes, who, without such knowledge, might venture amid all the uncertainty and danger of concealed lakes and labyrinths. He hoped soon to see this important paper published in the valuable Transactions of the Natural History Society of Newcastle.—Prof. Sedgwick fully concurred in what had fallen from Dr. Buckland. He stated that he had that morning the satisfaction of learning that coal had been bored for and discovered near Hartlepool, 8½ miles beyond its former known limits, thus marking a still further extension to the south-east of this great basin. The strata bored through were detritus, and grits belonging most probably to the red sandstone below the magnesian limestone, or, as it is called, *rothe liegendes*, the magnesian limestone itself, which is, in fact, a mere capping, being absent on account of the gradual declension of the ground towards Hartlepool.—Mr. De la Beche started the question of the origin of coal—whether the vegetable matter grew where we now find the coal, or was drifted from a distance. He expressed no positive opinion of his own, but cited the upright position of many fossil trees as an argument for the former view, and stated, that M. Adolphe Brongniart confesses himself to be every year more and more confirmed in the opinion that the coal strata were analogous to our peat bogs. Mr. De la Beche remarked, that in such vegetable accumulations in these countries, we had no proper term of comparison; but that such did exist in many places within the tropics.—Prof. Phillips argued in favour of the theory of the drifting, from short distances, of the plants which produced the coal. He showed how, upon the other theory, the alternation of the seams of coal with sedimentary sands and silts, would require a great number of successive depressions and elevations, and argued in favour of the theory of transport, from the mechanical nature of the earthy beds, and from the fact mentioned by Mr. Buddle of the great Eworth band being fine when thin, and, when attaining the thickness of 18 fathoms, coarse and pebbly.—Mr. Lyell stated that there were examples of alternate risings and sinkings, such as Brongniart's theory required; but drifting was a much more common occurrence, and had, in this case, much more of the semblance of a "true cause." Trees might float down, and even settle in a vertical position, as the snags now do in the Mississippi. Mr. Lyell then explained the structure of these upright trees, by showing that they had been hollow stems into which sand had fallen and become sandstone, while the bark became coal: the bark, from its weakness, was unable to support the pressure from within, and often gave way, producing accidents in mines. He said it was important to observe that the upright fossil trees were not all based on the same horizontal level.—Mr. Buddle remarked the important fact, that it was only the sigillaria that were found upright: they were found also in other positions, but no other trees were ever vertical.—Dr. Buckland added to this the curious and decisive fact, that no leaves of sigillariæ had been ever found, though there were markings on the trees which showed that they were once there; and that leaves were frequent in the coal formation.—Mr. James Bryce observed, that a great many calculations had been made at different times respecting the duration of the coal seams of the Newcastle field; that conclusions differing widely from one another had been arrived at, and he wished to ask Mr. Buddle, as the person best qualified to judge, his opinion upon this important point.—In reply, Mr. Buddle stated that he would now give the same answer which he had made to a Committee of the House of Lords, when asked the same question—no calculation could come at all near the truth—it must be a mere rude guess. The problem was most difficult, and was so complicated by various circumstances, which he need not now mention, that he never had undertaken and never could undertake the labour necessary to enable him to give a definite answer. He was of opinion that the working of the coal seams never could be carried far under the magnesian limestone near the sea shore, with any prospect of profit: indeed, he considered the art of mining in its present state to be insufficient to overcome the great difficulties to be encountered in the vast increase of temperature which would be met with, and the enormous additional weight which would require to be supported.

A paper was read by the President of the Section, Mr. C. Lyell, 'On Vertical Lines of Flint, traversing Horizontal Strata of Chalk, near Norwich.'

It has long been known that near Norwich the horizontal beds of flint nodules in the white chalk are often crossed by perpendicular rows of much larger flints, often several yards in height. These larger and vertical flints are provincially called potstones, and are the same as those described by Dr. Buckland as occuring in the chalk of Ireland under the name of *paramoudra*. At a place called the Grove's End House, near Horsted, about six miles from Norwich, an excavation has been made, from 15 to 20 yards wide, and nearly half a mile in length, in the shape of a canal, through 26 feet of white chalk, covered by strata of sand, loam, and shelly gravel, about 20 feet thick. In the chalk thus intersected, the rows of potstones are remarkable for their number and continuity; for it is affirmed by those who for more than twenty years have superintended the cutting of the canal, that every row of upright flints has been found to extend from the top to the bottom of the chalk, so far as the excavation has been carried downwards. The rows occur at irregular distances from each other, usually from 20 to 30 feet apart, and they are not portions of continuous siliceous beds in a vertical position, but piles of single flints running through the chalk, like so many wooden stakes driven into mud. Few of the separate flints are symmetrical, but some are pear-shaped. They are very unequal in size—usually from a foot to three feet in their longest diameter. At the point of intersection between a row of potstones and one of the horizontal beds of flints, there is no mutual interruption or shifting, but they are united as if both were formed at one time. Each potstone is not siliceous throughout, like the nodules of flint in the horizontal beds, but contains invariably within it a cylindrical nucleus of chalk, which, when deprived of its siliceous envelope, has the form and smooth surface of a tree when stripped of its bark. This internal mass of chalk is much harder than the ordinary chalk surrounding the flints, and does not fall to pieces when exposed to frost: it penetrates the flinty covering at the top and bottom of each potstone. A ventriculite was observed in the chalky nucleus in one instance. The author concluded by inviting those geologists who resided near Norwich to examine these phenomena more minutely; and, after adverting to the late discoveries of Ehrenberg, declared his expectation that the origin both of the vertical and horizontal masses of flint, would be found to be intimately connected with the fossil remains of infusoria, sponges, and other organic beings.

Dr. Smith had seen these flints thirty-five years ago in other places near Norwich, in boring wells.—Prof. Sedgwick thought that the narrowing of the flints at one end, and the slight breaks in continuity which took place, went against Mr. Lyell's hypothesis. He thought it much more likely, that these potstones were petrified sponges, analogous to those hard leathery bodies, seen in museums, called Neptune's cups. These bodies were propagated by the young one growing from the lip of the old; and the latter, when dying, and being converted into chalk or flint, might give off from its lips a new one, to continue the species, and thus a row would be formed. He also mentioned the analogy of these potstones to those singular flints of the Irish chalk, which Dr. Buckland had long ago called paramoudras.—Dr. Buckland said that Dr. M'Donnell, of Belfast, was the first person who called attention to the singular bodies referred to. He himself had now given up his first idea, that they were organic bodies; and thought it much more probable that they were a mere chemical segregation of the siliceous matter from a calcareo-siliceous mixture. In confirmation of this, he mentioned the fortuitous experiment made many years ago at Mr. Wedgewood's: a pulpy mass, prepared for the pottery, had been left standing for some time, when it was found that the siliceous matter had separated,—in fact, that a mass of flint had been formed.—Mr. Lyell observed, that this occurrence at Mr. Wedgewood's pottery had been often quoted, and he thought hasty conclusions built upon it. He was first led to investigate the matter by Dr. Faraday having expressed to him a doubt on the subject, on chemical grounds; and he found, on strict inquiry, that the circumstance could not be shown to have ever happened; no person worthy of credit knew anything about it. He had requested the present Wedgewoods to make an experiment of the kind.—Mr. Griffith then gave a short account of the Irish paramoudras, from which it appeared that they present many points of resemblance with the potstones described by Mr. Lyell.

A short notice of 'Lunar Volcanoes,' by Mr. Webb, was then read.

He had for some time examined the moon with an excellent five-feet achromatic, and had found that several volcanic vents existed not laid down in Schroeter's map of the lunar surface; and, also, that several vents, which had been so laid down, were now much enlarged in dimensions. Upon the whole, however, he considered that the moon and earth were similar in this respect,—namely, that volcanic action was now less violent than it had been in bygone periods.

Mr. Lyell said, that the value of these observations depended entirely on the point, whether Schroeter's map of the moon could be relied upon for accuracy or not. He believed it was quite correct at the time it was made, but could not speak positively. Sir John Herschel had lately told him that the moon's mountains were not higher than the earth's, but bore about the same relation to her own size that the earth's bore to hers.

Sir George Back, who now took the chair, observed that though the northern regions of the globe had for many years been his peculiar province, and many a bitter day he had passed in those cheerless latitudes, yet he could not but feel much gratification in calling the attention of the Section to a native of a tropical

clime, then present, whose appearance alone was sufficient to cause a more than ordinary interest in his fate.

The Secretary then read, 'A Brief Account of a Mandingo, Native of Nyáni-marú, on the River Gambia,' by Captain Washington, R.N.

Although the special object of our inquiries, said Captain Washington, as geographers, is the surface of the earth which we inhabit, yet, as has been well remarked, that earth is only interesting to us as the abode of man, "for whom it was created," it may be permitted to pause for a moment in our more ordinary researches, for the purpose of contemplating a native of one of the little known regions of Western Africa, and to mark the vicissitudes in the life of a Mandingo, who, in his native village, had seen and been in company with Mungo Park, one of the first and best of our African travellers, and successively to notice him as a slave, a soldier in the British army, a freeman, and finally, as about to return to the home of his fathers, and to impart to his countrymen some few of the blessings of civilization, which he may have acquired during an absence of more than a quarter of a century from the land of his birth. Mohammed-u-Siseï, was born at Nyáni-marú, a village of about 200 houses, on the northern bank of the Gambia, of Mandingo and Mussulman parents. At nine years old he was sent to school and learned to read the Korán and to write. At the age of seventeen he distinctly remembers an English traveller, called Mungo Park, passing through his native village on his way from Joka-kunda, where he had landed, to Pisaniara: this we know from the date of Park's second journey, was in the year 1805, which enables us to fix the age of Mohammed at from forty-eight to fifty. It were needless to relate the adventures of his life farther than to state that, in the year 1811, a neighbouring chief came to his native village on a slaving excursion, captured him among others, sold him to a French slaver, which was again captured by a British frigate, commanded by Sir Thomas Cochrane, and carried to Antigua—of course at once he became free—was placed in the 3rd West India regiment, in which he served from 1811 to 1825, having been present at the capture of Guadaloupe, &c. On the reduction of his regiment he remained in Trinidad, where he formed one of a Mandingo association of Mohammedans, who voluntarily subscribed funds among themselves to rescue their brother Mussulmans and countrymen from slavery. Mohammed remembers more than twenty being thus ransomed at an expense of from 300 to 700 dollars each, which this society voluntarily paid, and for several years, he says, no Mussulman has existed in slavery in Trinidad. He has now come to England on his way back to his native country. Very little intercourse with Mohammed will suffice to show that he has a good share of the intelligence generally found by travellers among the Mandingos. He is a strict Mussulman; he writes Mandingo in the Arabic character, and speaks English very tolerably. As already observed by Goldberry and Laing of the Mandingos generally, this man resembles in his features the Hindús more than the blacks of Africa in general. His features are regular and open, his person well formed, full six feet in height, his nose Roman, with the nostrils rather flattened, not thick lips, beautiful teeth, hair woolly, colour a good clear black, not jet. With the assistance of Mr. Renouard, a vocabulary of about 2000 words and phrases in the Mandingo language has been gathered from this native, besides itineraries in various parts of his country; and when we consider how extensively spread is the Mandingo language, perhaps the most so of any of the 36 families of languages into which authors have divided the 115 languages of Africa, and that hitherto a vocabulary of about 400 words is all that we possessed of it, it will be admitted that this native of the Gambia has not offered an unprofitable subject of geographical inquiry.

'Sketch of the recent Russian Expeditions to Novaïa Semlïa,' by Prof. von Baer.

The object of this sketch was briefly to enumerate the different expeditions chiefly sent out by the Russian government (see *Athenæum*, Nos. 535, 560), in order to illustrate a chart of Novaïa Semlïa, in which the outline of the islands was marked as represented in our most modern maps, and its actual outline as it is now known to exist; whence it appears that more than half the eastern portion of the land must be obliterated from our maps. It was remarked also with what zeal the Imperial Academy of Sciences at St. Petersburgh had lately prosecuted the course of physical geography. Sir George Back said, that it must be highly gratifying to himself as well as to other Arctic navigators, to know that the author of this paper attributed all the exertions made towards the examination of the shores of Novaïa Semlïa to the example which had been set by the British government in so steadily pursuing the cause of Arctic discovery, and to the benefit derived from the experience of Parry, Franklin, Richardson, and Ross, in the numerous privations they had suffered and the winters they had passed among the ice of the Polar Seas.

'On the recent Government Map of Mexico,' by Lieut.-Col. Don Joaquin Velasquez de Leon.

A brief notice was here given of a map of the whole state of Mexico, which had been constructed within the last few years; it pointed out also the site of the mines of coal near Chilpanzingo, about 120 miles south of Mexico; the iron mines of Zacualpam de Amilpas, 60 miles south of Tampico, and the tin mines of Acambay, near the north-eastern frontier.

Section D.—Zoology and Botany.

The proceedings of this day commenced by reading a paper 'On the Wild Cattle of Chillingham Park,' by J. Hindmarsh, of Alnwick. After some introductory observations on the great changes which the kingdoms of nature were undergoing throughout the world, and particularly those arising from the influence of civilization on man, the author stated that he had been obligingly assisted in his present efforts to give an account of the wild cattle of Chillingham, by the following communication from their noble proprietor:

"Grosvenor Square, 8th June, 1838.

"Sir,—Some time since I promised to put down upon paper whatever I knew as to the origin, or thought most deserving of notice, in respect to the habits and peculiarities of the wild cattle at Chillingham. I now proceed to redeem my promise, begging pardon for the delay. In the first place, I must premise that our information as to their origin is very scanty; all that we know and believe in respect to it rests in great measure on conjecture, supported, however, by certain facts and reasonings, which lead us to believe in their ancient origin, not so much from any direct evidence, as from the improbability of any hypothesis ascribing to them a more *recent* date. I remember an old gardener of the name of Moscrop, who died about thirty years ago, at the age of perhaps eighty, who used to tell of what his father had told him as happening to him, when a boy, relative to these wild cattle; which were then spoken of as wild cattle, and with the same sort of curiosity as exists with regard to them at the present day. In my father and grandfather's time we know that the same obscurity as to their origin prevailed; and if we suppose (as was no doubt the case) that there were old persons in their time capable of carrying back their recollections to the conversation still antecedent to them, this enables us at once to look back to a very considerable period, during which no greater knowledge existed as to their origin than at the present period. It is fair, however, to say, that I know of no document in which they are mentioned at any past period. Any reasoning, however, that might be built on their not being so noticed, would equally apply to the want of evidence of that which would be more easily remembered or recollected—the fact of their recent introduction. The probability is, that they were the ancient breed of the island, inclosed long since within the boundary of the park. Sir Walter Scott rather particularly supposes that they are the descendants of those which inhabited the Great Caledonian Forest, extending from the Tweed to Glasgow, at the two extremities of which, namely, Chillingham and Hamilton, they are found. His lines in the ballad 'Cadyow Castle' describe them pretty accurately at the present day:

> Mightiest of all the beasts of chace
> That roam o'er woody Caledon,
> Crushing the forest in his race,
> The mountain bull comes thundering on:
> Fierce on the hunter's quivered band
> He rolls his eye of swarthy glow,
> Spurns with black hoof, and horns the sand,
> And tosses high his mane of snow.

"I must observe, however, that those of Hamilton, if ever they were of the same breed, have much degenerated.

"The park of Chillingham is a very ancient one. By a copy of the endowment of the vicarage, extracted from the records at Durham, and referring to a period certainly as early as the reign of King John, about which time, viz. 1220, the church of Chillingham was built, the vicar of Chillingham was, by an agreement with Robert de Muschamp, to be allowed as much timber as he wanted for repairs, of the best oak out of the Great Wood of Chillingham, the remains of which were extant in the time of my grandfather. The more ancient part of the castle also appears to have been built in the next reign, that of Henry III., since which it has been held, without interruption, by the family of Grey. At what period, or by what process, the park became inclosed, it is impossible to say; but it was closely bounded by the domains of the Percies on the one side, and by the Hibburnes on the other, the latter of whom had been seated there since the time of King John; and as the chief branch of the Greys always made Chillingham their principal residence, until it passed into the hands of Lord Ossulston, by his marriage with the daughter and heiress of Ford Lord Grey, it is reasonable to suppose that, in order to secure their cattle, wild and tame, they had recourse to an inclosure probably at an early period. It is said there are some other places in which a similar breed is found: Lyme Park, in Cheshire; Hamilton, as I before mentioned; and Chartley Park (Lord Ferrers). The first I have not seen, but they are described as of a different colour, and different in every respect. Those at Hamilton, or, rather, Chatelherault, I have seen, and they in no degree resemble those at Chillingham. They have no beauty, no marks of high breeding, no wild habits, being kept, when I saw them, in a sort of paddock; and I could hear no history or tradition about them, which entitled them to be called wild cattle. Those at Chartley Park, on the contrary, closely resemble ours in every particular; in their colour, except some small difference in the colour of their ears—their size—general appearance: and, as well as I could collect, in their habits. This was a very ancient park, belonging formerly to Devereux, Earl of Essex, who built the bridge on the Trent, to communicate with his chace at Channock, and Beaudesert, then belonging to him; and the belief is, that these cattle had been there from time immemorial. With respect to their habits, it is probable that you will learn more from Cole, who has now been park-keeper at Chillingham for many years, than from any information I can give. I can mention, however, some particulars. They have, in the first place, pre-eminently, all the characteristics of wild animals, with some peculiarities that are sometimes very curious and amusing. They hide their young, feed in the night, basking or sleeping during the day;—they are fierce when pressed, but, generally speaking, very timorous, moving off on the appearance of any one, even at a great distance. Yet, this varies very much in different seasons of the year, according to the manner in which they are approached. In summer, I have been for several weeks at a time without getting a sight of them,—they, on the slightest appearance of any one retiring into a wood, which serves them as a sanctuary. On the other hand, in winter, when coming down for food into the inner park, and being in contact with the people, they will let you almost come among them, particularly if on horseback. But then they have also a thousand peculiarities. They will be feeding sometimes quietly, when if any one appear suddenly near them,—particularly coming down the wind, they will be struck with a sudden panic, and gallop off, running one after another, and never stopping till they get into their sanctuary. It is observable of them as of red deer, that they have a peculiar faculty of taking advantage of the irregularities of the ground, so that on being disturbed, they may traverse the whole park, and yet you hardly get a sight of them. Their usual mode of retreat is to get up slowly, set off in a walk, then a trot, and seldom begin to gallop till they have put the ground between you and them in the manner that I have described. In form, they are beautifully shaped, short legs, straight back, horns of

a very fine texture, thin skin, so that some of the bulls appear of a cream colour; and they have a peculiar cry, more like that of a wild beast, than that of ordinary cattle. With all the marks of high breeding, they have also some of its defects. They are bad breeders, and are much subject to the *rush*, a complaint common to animals bred in and in, which is unquestionably the case with these as long as we have any account of them. When they come down into the lower part of the park, which they do at stated hours, they move like a regiment of cavalry in single files, the bulls leading the van, as in retreat it is the bulls that bring up the rear. Lord Ossulston was witness to a curious way in which they took possession, as it were, of some new pasture recently laid open to them. It was in the evening about sunset. They began by lining the front of a small wood, which seemed quite alive with them, when all of a sudden they made a dash forward altogether in a line, and charging close by him across the plain, they then spread out, and after a little time began feeding. Of their tenacity of life the following is an instance. An old bull being to be killed, one of the keepers had proceeded to separate him from the rest of the herd, which were feeding in the outer park. This the bull resenting, and having been frustrated in several attempts to join them by the keeper's interposing, (the latter doing it incautiously) the bull made a rush at him and got him down; he then tossed him three several times, and afterwards knelt down upon him, and broke several of his ribs. There being no other person present but a boy, the only assistance that could be given him was, by letting loose a deer-hound belonging to Lord Ossulston, who immediately attacked the bull, and by biting his heels drew him off the man and eventually saved his life. The bull, however, never left the keeper, but kept continually watching and returning to him, giving him a toss from time to time. In this state of things, and while the dog with singular sagacity and courage was holding the bull at bay, a messenger came up to the castle, when all the gentlemen came out with their rifles, and commenced a fire upon the bull, principally by a steady good marksman from behind a fence at the distance of twenty-five yards; but it was not till six or seven balls had actually entered the head of the animal, (one of them passing in at the eye) that he at last fell. During the whole time he never flinched nor changed his ground, merely shaking his head as he received the several shots. Many more stories might be told of hair-breadth escapes, accidents of sundry kinds, and an endless variety of peculiar habits observable in these animals, as more or less in all animals existing in a wild state: but, I think I have recapitulated nearly all that my memory suggests to me, as most deserving of notice; and will only add, that if you continue in the intention of preparing a paper to be read before the approaching Scientific Association at Newcastle, on this subject, you are welcome to append this letter to it, as containing all the information I am able to give.—I have the pleasure &c.,

TANKERVILLE."

"To L. Hindmarsh, Esq."

In addition to this letter, Mr. Hindmarsh communicated some information, collected from Mr. Cole, the keeper, and from his own observation. There are about 80 in the herd, comprising 25 bulls, 40 cows, and 15 steers, of various ages. The eyes, eye-lashes, and tips of the horns alone are black, the muzzle is brown, and the inside of the ears red or brown, and all the rest of the animal white. Even the bulls have no manes, but a little coarse hair on their neck. They fight for supremacy, until a few of the most powerful subdue the others, and the mastery is no longer disputed. When two bulls are separated by accident, they fight when they meet, although friendly before, and do so till they become friends again. The cows commence breeding at three years old; the calves suckle nine months; they conceal their calves for a week or ten days after they are born, suckling them two or three times a day. The late Mr. Bailey, of Chillingham, found a calf, two or three days old, very poor and weak. On stroking it, it retired a few paces, and then bolted at him with all its force; he stepped out of its way, and it fell down, when the whole flock came to its rescue, and forced him to retreat, being a strong fact in support of the opinion of their natural wildness. They do not often die from disease, but they are seldom allowed to live more than eight or nine years, at which period "they begin to go back." When slaughtered, they weigh from 38 to 42 stones. One was caught and kept, and became as tame as the domestic ox, and thrived as well as any short-horned steer could do, and, in its prime, was computed to weigh 65 stones. They are shy in summer, but tame in winter, and will eat hay from a fold, although they will not taste turnips. When one of the herd becomes weak or feeble, the rest set upon it, and gore it to death. At the end of the last century, similar cattle existed at Burton Constable, Yorkshire, and at Dunnlary, in Dumfriesshire, but these are now extinct. From the absence of all recent notice of these animals, there appears to be little doubt but they are genuine descendants of the wild cattle of the ancient Caledonian forests. The author then quoted a passage from Boetius, which, allowing for a little colouring, described these animals very well, except in the non-existence of a mane. The cattle at Dunnlary had black ears, but in all other points resemble those of Chillingham; and this may be accounted for by a statement of Bewick, that about forty years ago some of the animals had black ears at Chillingham, and were shot by the keeper. On the whole, the author was inclined to think these animals the survivors of the Caledonian cattle, which undoubtedly extended through the northern provinces of England; and that, under the protection of the owners of Chillingham, they had escaped the general destruction dependent on the advancement of civilization, &c. in the country.

Mr. P. J. Selby knew these cattle very well; they had been the same ever since he remembered them. Mr. Swainson had thought them a different genus to the common ox, and placed them under Urus.—Mr. Gray thought them distinct from the Urus.—Dr. Greville mentioned the existence of wild cattle in Ribblesdale Park, one of which was stated by Mr. Turner to exist in the Manchester Museum of Natural History.—Mr. Webb Hall thought this an important paper, although opposed in its results to the received opinions of cattle-breeders. Here was a race breeding in and in, yet retaining all its beauty, strength, and vigour. This was opposed to all known facts.—Hr. Hall's remarks excited considerable interest; and it appeared, that in the present instance great care had been taken to prevent the deterioration of the breed, which had undoubtedly taken place in other herds. The question of the genus to which this animal ought to be referred could not be decided by any evidence brought before the Section; and Sir W. Jardine suggested, that as undoubtedly the noble proprietor of the cattle would allow one of them to be examined, some competent naturalist should do this, and report upon the peculiarities of this animal.

'On the Production of Vanilla in Europe,' by Prof. Morren, of Liege.

The Professor commenced by stating, that some difficulty at present existed in determining the species from which the vanilla of commerce was produced, but the *Vanilla planifolia* would produce it. This plant does not naturally produce odoriferous fruit; but Mons. Morren had succeeded in obtaining, for two years running, fruits as large and odoriferous as those of commerce. The author remarked, that the cultivation of this plant might be now attempted in our intertropical colonies, with the application of the principles of modern botanical science, when this substance might be obtained at a much lower price than at present. The author thought the cultivation of the vanilla plant could not take place in the British isles. In order to obtain good fruit, the plant should be allowed to grow five or six years; the fruit was not in proportion to the flowers; and the older, the larger, and the more branches the plant possessed, the better was its fruit. Exposure to the sun was not necessary for the maturation of the fruit, shade, heat, and humidity being the three conditions necessary for the flowers. The stigma of the plant is supplied with a peculiar appendage which covers over the stigmatic surface in the form of a veil, which requires to be lifted up before the artificial impregnation of the plant can take place. The author went into several particulars for the successful cultivation of the plant.

Mr. Turner, of Manchester, then exhibited several specimens of rare insects from the Museum of the Manchester Natural History Society. They were described by the Rev. F. W. Hope, as consisting of a species of Lucanus from South Africa, another of the genus Cupes, a third a species of Danaus, and a fourth a rare insect belonging to a group he had distinguished by the name Dicromorina.

Dr. Parnell read a paper 'On some new and rare Specimens of British Fishes.'

He commenced with the genus Motella of Cuvier, stating that *M. quinquecirrata* and *M. vulgaris* were common; but he had received the *M. cimbria*, which was caught in the Frith of Forth in June last. This is the *Gadus cimbrius* of Linnæus, and was by him supposed to be confined to the Atlantic and Norway seas, and is distinguished by the first ray of the anterior dorsal fin presenting the form of the letter T. It is closely allied to *M. quinquecirrata*, but differs from it in the snout, having three instead of four barbales; the teeth are sharp and slender, and in two rows instead of three, as in *M. quinquecirrata*; the eye is much larger, the snout more produced, and the lateral line very much more distinct. The cæcal appendages were few in number; the roe large, and the ova apparently in a fit state to be deposited.

2. *Pagellus acarine*. He had met with four specimens of this rare bream in the Frith of Forth. This species is at once detected by the black spot at the base of the pectorals.

3. *Raia chagrinea*. This fish is described by Montague and Pennant; and Mr. Yarrell has figured one, which is probably a new species. The principal distinction of the *R. chagrinea* of Montague, is in the dorsal surface of the tail having only two rows of spines, and none on the central ridge. These rows commence at the first dorsal fin, and extend nearly as far as half way up the back of the fish, where the spines become very small, and not half the size of those on the lower portion of the tail. It is occasionally taken in the Frith of Forth in May and June; and known to fishermen by the name of Rough Flapper.

4. *Raia intermedia*.—This fish was obtained in the Frith of Forth, in the month of May, and seems to be a new species of skate. It appears to be the connecting link between *Raia batis* and *Raia oxyrhynchus*, to both of which it is closely allied; and it is from this circumstance that the specific name of Intermedia was suggested. It is distinguished from *Raia batis*, in the upper surface of the body being perfectly smooth without granulations, and of a dark olive colour, spotted with white; in the anterior part of each orbit, it is furnished with a strong spine: in the dorsal fins being more remote from each other, and in the anterior margin of the pectorals being rather more concave. It is distinguished from *Raia oxyrhynchus* in the snout being conical; the under surface of the body dark grey: a spine in front of each orbit, and the back of a dark olive green, spotted with white.

5. That the adult male thornback (*Raia clavata*) has sharp-pointed teeth, does not appear a character so constant as is supposed by some authors, since he had met with several full-grown examples, in which the teeth were as blunt as those observed in the female thornback. One of the specimens exhibited, obtained in the Frith of Forth, in the month of September, presents the following characters; length of the whole fish two feet two inches; anal appendages six inches, extending half-way down the tail; near the tip of the broadest part of each pectoral, is a row of long reclined spines, with their points directed towards the dorsal line; teeth blunt, allowing the finger to be passed in either direction over their summits, without the vestige of a point to be felt; the teeth being as blunt as those observed in the female specimens of the thornback.

In the first volume of the *Zoological and Botanical Magazine*, the author described two new species of British fishes, taken on the south coast of Devon, the *Trigla lucerna*, and the *Monochirus minutus*, specimens of which were exhibited.

6. *Cottus scorpicus*.—A large and characteristic specimen of this fish, taken in the Frith of Forth, its usual length being about six or seven inches, was exhibited. It was first described as British by Mr. Yarrell.

7. *Platessa limandoides*.—This species of flat-fish, which the author first noticed, as new to the British Fauna, about three years ago, he now finds to be a

very common species, on the coast of Scotland, and has also observed it several times on the coast of Devon.

8. *Platessa pala.*—The only localities known for this fish, on the British coasts, are the Frith of Forth and the coast of Devon, in both of which places the author has frequently met with it.

9. *Mugil chelo.*—This fish, as common as it is on many parts of the British coast, has been long mistaken for the *Mugil cephalus* of Cuvier, and is also confounded by many with the *Mugil capita*. Dr. Hancock appears to have been the first of our own naturalists to remark, that the grey mullet of the British coast was not the true *Mugil cephalus*: he named it *Mugil Britannicus*. According to Mr. Yarrell, Mr. Couch is the only naturalist who has noticed the appearance of *Mugil chelo* on the British coast. This fish, the author observed to be excessively common in the months of September and October on the Devonshire coast, particularly off Exmouth, Teignmouth, and Brixham. He has found it common on the west coast of Scotland, and, consequently, large shoals of them appear on the east coast. Dr. Johnson has noticed it off Berwick, and in some seasons numbers are taken off Dunbar, and sent to the different markets for sale. Scarcely a summer passes, but that a few are found at the different fishing stations in the Frith of Forth, and occasionally of large size. The specimen now before me (the author observed) measures twenty-three inches in length, although the common size is about a foot in length.

10. *Trigla gurnardus.*—From a closer examination of several specimens of all sizes of this species of gurnard (the *Trigla Blochii* of Yarrell, and *Trigla cuculus* of Bloch and Jenyns), the author was induced to consider it as nothing else than the young of the grey gurnard (*Trigla gurnardus*), the characters varying according to the age of the fish. The characters by which this fish is said to be distinguished from the grey gurnard, are, first dorsal fin with a black spot: the dorsal ridge and lateral line strongly serrated, and the first three dorsal rays smooth. The characters of an adult grey gurnard are, the dorsal fin plain, without a black spot; the dorsal ridge and lateral line crenated, and the first three dorsal rays granulated. But, if we examine a specimen of nine inches in length, it will be found to possess the characters of both species—namely, the first dorsal fin will have the rudiments of a dark spot; the dorsal ridge will be partly crenated and partly serrated, and the lateral line, rough and serrated. *Trigla Blochii* is said never to attain to the size of the grey gurnard. In no instance has he found the young of the grey gurnard possessing the characters of an adult, but bearing always those which are assigned to *Trigla Blochii*. We have six or seven British species of gurnards, all of which have been greatly confounded for the want of not having previously discovered some constant specific character; but the author has found, that the form of the scales of the lateral line is quite sufficient to distinguish the different species, independent of any other character, the scales of the lateral line of no two species being alike.

A long discussion then ensued on the last statement of the author, with regard to the *Trigla Blochii*, and *Tr. cuculus* being the young of *T. Gurnardus*, in which Messrs. Yarrell, Jenyns, and Thomson took a part.

The next paper was by Mr. J. Hancock, 'On the *Falco Islandicus* of authors,' and was illustrated by a specimen and several drawings. The author observed, that under the name of *Falco Islandicus*, two distinct species had been included. He then went into a lengthened examination of the subject, pointing out the errors into which zoologists had fallen, from not having had sufficient opportunities of examining these birds in their native regions. The confusion on this subject appeared to have arisen from the changing nature of the plumage in these birds, the young of one species resembling the old of another in certain states of its tegumentary appendages, and having thus led naturalists to confound one with the other. The author having had opportunities of observing accurately these birds, had come to the conclusion, that under the name *Falco Islandicus* two distinct species existed; and concluded his paper by stating, that he had retained Latham's name of *Islandicus* for the true Iceland species, as the most appropriate, it being peculiar to that island. The other he named after the country in which it is most abundantly procured, *Grœnlandicus*, and which, in fact, was the name given to the young of the other bird by Linnæus. The descriptions of these birds were as follows:—*Falco Islandicus*, ground of the upper plumage a dark lead or mouse colour, barred and spotted with cream colour, under parts ground buff, marked with streaks, heart-shaped spots and bars of dark mouse colour, wings reaching to within one inch and a half of the end of the tail. Synonyms, figures, &c.: Iceland Falcon, Penn. Arc. Zool. adden. C, vol. 1, p. 252. Greenland Falcon, Penn. Arc. Zool. adden. D, vol. 1, p. 257. Collard Falcon, Penn. Arc. Zool. vol. 1, p. 158. *Falco gyrfalco*, Tur. Linn. vol. 1, p. 158. Iceland Falcon, Lath. No. 50: dimensions, adult male, length one foot nine inches; extent of wings three feet ten inches: female, one foot eleven inches, wings four feet two inches. *Falco Grœnlandicus*, ground of the plumage pure white, upper parts elegantly marked with arrow shaped spots of a dark grey, under parts and head streaked with the same, wings reaching to within two inches of the end of the tail, second primary the largest. Synonyms and figures: Gyrfalcon, Penn. Arc. Zool. vol. 1, p. 232. *Falco Grœnlandicus*, Tur. Linn. (this is the young,) vol. 1, p. 147. *Falco Islandicus*, Tur. Linn. vol. 1, p. 155. *Falco candicans*, Tur. Linn. vol. 1, p. 158. Iceland Falcon, Var. Lath. p. 71. Spotted Iceland Falcon, Var. Lath. 71: dimensions, adult male, length one foot nine inches: female, length one foot eleven inches; extent of wings three feet ten inches. The paper was illustrated by some well-executed drawings; and a stuffed specimen of the bird was exhibited.

Mr. Strickland thought we ought to be careful in distinguishing species by their colour alone; but we must confess, that the author of the paper had made out a very strong case in support of the distinction of the two birds he had alluded to. He thought the fact of the existence of two species of this kind existing, was in some measure confirmed by the circumstance that falconers were in the habit of selecting their falcons from a particular locality, as the others were not so valuable birds, those from Iceland being preferred. Why this subject had not been clearly understood, was the difficulty of procuring Iceland falcons, which were, in fact, monopolized by the King of Denmark for his private use. This paper seemed, however, to have cleared up the difficulty.—Mr. Selby had never had the opportunity of seeing this bird before, and his impression, from the remarks in the paper, was, that there were two distinct species.—Mr. Fox took this opportunity of stating, that in the Museum of the University of Durham there was a fine collection of Iceland birds; Mr. Proctor, the sub-curator of that museum, having been sent out to that island for the express purpose of collecting birds, and having come home, after making remarkable exertions, with not less than 150 different species, being fifty more than had been at present described as existing in that island.

Col. Sykes read a paper on a rare animal, from South America. It was described by Azara, a Spanish naturalist, as *Canis jubatus;* but the description given by Azara himself of this animal, led the author to suppose it ought not to be placed in that genus. It differed from the dog tribe in its nocturnal and solitary habits: its tail was thicker, more bushy, head flatter, eyes smaller, nose sharper, and the whole animal more bulky than the dog tribe. If it differed from the dog, it differed more from the fox and wolf; and he proposed to refer it to the genus hyæna, or, if this could not be admitted, he would make it a distinct genus, which would then be the representative of the hyæna tribe in America, which we must suppose possessed some analogue of that tribe in the old world. He also exhibited the skin of a European Felis, which Temminck states is known as the lynx of Portugal: it is not, however, known by this name amongst London furriers.

Mr. Gray thought the first animal must be considered as a Canis; but as only the skin had been procured, it would be impossible to decide.

The next paper was 'On Vegetable Monstrosities,' from his collection, by the Rev. W. Hincks.

The author made some introductory remarks on the importance of the study of monstrosities, and concluded by a distribution of them into five classes:—1. Cases of coherence and adherence of parts not usually united, or of separation of those which are ordinarily connected. 2. Anomalies depending on the comparative developement of parts of one circle. 3. Anomalous transformations of organs. 4. Monstrous exuberances of growth, by which the number of parts is altered, independently of transformation, the number of circles of parts is increased, or the axis irregularly extended. 5. Anomalous abortions or suppressions of parts usually present in the species. Among the monstrosities produced belonging to the first class, were a specimen of *Convallaria multiflora*, in which the two lowermost leaves cohered by their edges into a sort of bag, which considerably obstructed the growth of the stem; a specimen of *Tulipa Gesneriana*, in which the leaf, on the stem folding round it, had cohered by its edges, so as completely to enclose the flower-bud, which, as it enlarged, carried up the upper part of the leaf, like the calyptra of a moss, or the calyx of Escholzia, and some adherent flowers, of which a specimen of *Salpiglossis straminea* was remarkable for the complete union of two flowers, so as to have but one calyx and corolla each, with a double number of parts. In the third class, a specimen was exhibited of *Campanula rapunculus*, with the bell-shaped corolla transformed into five additional stamens; and one of *Lilium longiflorum*, with the stamens partially transformed into pistils, a stigma being produced at the extremity of each, whilst an imperfect anther was borne lower on the filament. Various other examples were produced in the several classes, which cannot be particularly noticed.

Section E.—MEDICAL SCIENCE.

The Section did not meet until half-past eleven o'clock, as the greater number of Members had gone by invitation to be present at the operations performed in the infirmary. The first paper was read by Mr. Torbock on Uterine Hæmorrhage, the object of which was to introduce a new mode of applying pressure in certain forms of the disease. A few cases were adduced in proof of its efficiency.

A conversation ensued, in which the danger of relying on any *merely* mechanical treatment, to the exclusion of fundamental principles previously established, was pointed out by Drs. Granville, Lynch, and Knott.

Dr. Robert D. Thomson then read a paper, by Mr. N. Farr 'On the Law of Recovery and Mortality in Cholera Spasmodica.'

Dr. Thomson introduced his subject by making some general remarks upon the importance of applying the precise language of mathematical science to all branches of natural knowledge; and, after apologizing for bringing mathematical formulæ before medical men, stated that the only mode of placing medicine on a level with the sciences which are of a demonstrable, and therefore irresistible nature, will be by establishing it on a mathematical basis—for until we can calculate with absolute precision on the natural laws of diseases, and on the action of remedies, we can be only said to labour in our vocation like the ancient mariners, who could never venture beyond the confines of the ocean without suffering the most disastrous consequences. Dr. Thomson had been induced to bring the present subject before the Medical Section at the request of the able author, whose absence he regretted, for the purpose of showing that the law which regulated the disease so well known under the name of Indian cholera was as precise as any of those which guided the heavenly bodies in their courses. It was a curious fact that the state of medicine was so far in arrear in this country, that, although numerous cholera hospitals had been established in this country during the prevalence of that disease, not one of their conductors had paid any attention to the proper mode of registering the features of the disease, so as to render them available for drawing conclusions of any value; and that the only place which had hitherto afforded the proper data for this purpose was Rome, a city to which many persons were ignorantly inclined to deny any credit in a scientific point of view. The subsequent conclusions were deduced from 9372 registered cases, in 1837, published by the Roman Board of Health in their report, for which the author was indebted to Sir James Clark. It affords a striking proof of the importance of Boards of Health and of the great superiority of the Papal provisions for the

health of the inhabitants, and formed a striking contrast to the laws of England. It would be highly desirable, in the absence of such provisions by government, that physicians of hospitals should decide upon a uniform method of registering the principal features of diseases. The principal points to attend to were the *day of the disease*, or day of attack; second, the *day of recovery*, distinguishing males from females; and third, the *day of death*. From data of this kind the extensive tables presented to the meeting were deduced. One of these tables exhibited the numbers dying and recovering on each day after attack, and contained calculations from theoretical considerations, which closely approached the amounts derived from facts. The following table will show this more clearly:—

Out of one hundred constantly sick:

	Deaths.		Recoveries.	
	Observed.	Calculated.	Observed.	Calculated.
5th day..	5.471	5.650	6.747	6.747
6th.....	5.684	5.056	8.295	7.929
7th.....	4.500	4.523	9.219	9.317

The following table expresses the probability of recovery and death during the first ten days after attack:—

Days.	Probability of Recovery.	Probability of Death.
0	.422	.578
1	.542	.458
2	.668	.332
3	.729	.271
4	.763	.237
5	.791	.209
6	.821	.179
7	.843	.157
8	.862	.138
9	.873	.127
10	.883	.115

From the tables may be deduced the following problems:—viz. 1st, the mean duration of the disease; 2nd, the mean future duration of the disease at any period; 3rd, the probability of dying at any period of the disease.

Dr. Granville deprecated the attempts to introduce laws mathematically drawn or expressed, into the immediate subjects of medical inquiry, such as the present. The laws derivable from physical inquiries, such as astronomy, had their value from the known laws of gravitation, but no similar fundamental law was known in physiology; and the innumerable modifying circumstances, such as differences of age, sex, treatment, and diversity of constitution, would interminably disturb any deductions thus made on the questions of disease.—Dr. Thomson, in answer, referred to the close coincidence of the law (expressed by a mathematical curve) and the observations recorded, and explained some points in the structure of the tables.—Dr. Sargent differed from Dr. Granville as to the impracticability of ever arriving at any approximation to such a law as that, now exhibited. It was impossible to view the tables before them, even cursorily, to compare them with the manifest deduction as to regular gradations, and with his own observations on the gradual diminution of the mortality of the dreadful epidemic in several invasions, without coming to the conclusion, that the coincidence, or approximation of the observations and calculations, must have a foundation in nature. As to the modifying circumstances mentioned, these were difficulties, no doubt, not to be overlooked: and did not disturbing elements and difficulties occur in physical investigations?

Mr. Joseph Blake then read a paper 'On the action of various Substances on the Animal Economy, when injected into the Veins,' in which were detailed a number of experiments with various substances, and their effect on the vascular system, measured by an ingenious instrument, which the author denominated a Hæmadynameter, formed by a glass tube, having both extremities proceeding from an angle, —one being attached to a scale, measuring the height to which a column of mercury was raised by the action of the current of blood in the artery, into which the other extremity was introduced. The substances introduced, in solution, into the veins, were divided into three classes, from their effects. In the *first*, were those which produced death, by directly acting on the contractility of the heart, amongst which were nitrate of potassa, arseniate of potassa, sub-carbonate of soda, biniodide of arsenic, oxalic acid, and solution of galls; all these acted locally on the heart, and agreed in effecting a change in the colour of the blood, turning it black, probably by forming definite combinations with its constituents. A remarkable difference was observable from the effects of the same substances when absorbed from the stomach. In the *second* class, were those substances which acted directly on the nervous system; such were strychnia, hydrocyanic acid, and conia. And in the *third*, were those producing death by affecting the capillary circulation; such were tobacco, euphorbium, and digitalis. The two last classes of substances did not produce any change on the composition of the blood. Several other substances were experimented with, not falling under the above classes, such as morphia and cantharides, the effects of which were the same,—and nitric acid: when the latter was injected into the vein, the column of mercury in the instrument fell from seven inches to one; and after death, the right side of the heart was distended with solid blood.

Dr. Lynch and Mr. Torbock corroborated the observations made in the first class of substances employed, having observed the same changes in the blood produced by acids under different circumstances.

Dr. Barnes then read a paper, containing a report of two cases of well-marked abscess of the lungs from acute inflammation.

Section F.—STATISTICS.

The first paper read was 'Statistical Illustrations of the Principal Universities of Great Britain and Ireland,' by the Rev. H. L. Jones.

The books used in compiling these Statistical Tables, were the Oxford, Cambridge, and University Calendars for 1838, and the Report on the Scotch Universities, presented to the House of Commons in 1831: besides this, much private information had been used in determining the value of fellowships, the number of members resident, &c., points on which the University Calendars are silent. The College Revenues of Oxford, Cambridge, and Dublin, were minutely detailed, and the result may be thus stated:—

	Oxford.	Cambridge.	Dublin.
Heads of houses.....	24 ..	17 ..	1
Income	£ 18,350 ..	£ 12,650 ..	£ 2,000
Fellows.....	557 ..	431 ..	25
Income	£116,560 ..	£ 90,330 ..	£25,400
Scholarships	339 ..	793 ..	70
Income	£ 6,030 ..	£ 13,390 ..	£ 2,100
College-officers	199 ..	179 ..	10
Income	£ 15,650 ..	£ 17,750 ..	£20,000
Benefices	455 ..	311 ..	31
Incumbents	430 ..	280 ..	31
Income	£136,500 ..	£ 93,300 ..	£ 9,300
Rent of Rooms	£ 11,730 ..	£ 15,860 ..	£ 2,000
College Revenues	£152,670 ..	£133,268 ..	£31,500

The second table contained an account of all the members on the books, or boards of each university. The title S.M., or Student of Medicine, is peculiar to Oxford; that of ten-year men is peculiar to Cambridge:—

	Oxford.	Cambridge.	Dublin.
Noblemen	78	116	3
Doctors of Divinity ..	123	56	22
—— of Law	87	23	13
—— of Medicine..	30	40	6
—— of Music	1	1	1
Bachelors of Divinity	205	162	1
Masters of Arts.....	2137	2298	29
Bachelors of Law....	56	59	1
——— of Medicine	8	53	
——— of Arts....	951	1015	162
——— of Music ..	4	1	
Students of Law	30	5	
——— of Medicine	4		
Fellow-Commoners ..	201	166	185
Pensioners.....	1325	1321	1159
Servitors or Sizars ..	.....	146	42
Ten-year Men	.....	141	
Total	5264	5575	1624

The third table referred to the ranks of the members, and the stimulating forces—that is, the amount of pecuniary advantage offered for exertion:—

	Oxford.	Cambridge.	Dublin.
Number of Members	2,618 ..	3,430 ..	1,422
College Revenues	£279,170 ..	£226,568 ..	£40,800
Stimulating force, per head	£106 6s. ..	£66 ..	£28 7s.

The fourth table presents nothing remarkable; the fifth declared the number of lecturers and professors:—London, 50—Dumfries, 10—St. Andrew's, 13—Aberdeen, 28—Glasgow, 21—Edinburgh, 30—Dublin, 29—Cambridge, 49—Oxford, 32. The sixth table was a summary of the preceding.

The discussion on this Report was confined to an explanation of the circumstances, in which the Dublin University differed from those of Oxford and Cambridge, especially its admission of dissenters to degrees, and not requiring residence.

'On the Educational, Criminal, and other Statistics of Newcastle,' by Mr. W. Cargill.

The inquiries were commenced last January, and continued, with little interruption, to the 18th of the present month, and were conducted with great industry and accuracy. The present population of Newcastle was estimated at 64,000, and the number of children between the ages of five and 15, at 16,000. The number of children receiving instruction of any kind, was 8209, the uneducated 7761, or nearly the same proportion destitute of instruction, as was found in the Liverpool Report.

Total number of day-schools	128
Ditto of teachers	178
Ditto of Sunday-schools.....	16
Ditto of children attending Sunday-schools.....	5639
Ditto of Sunday-schools belonging to Established Church	10
Ditto .. .. to Dissenters	2

Reading only, taught in 29 schools.
Reading and writing, in 11 schools.
Reading, writing, and arithmetic, 28 schools.
Other branches, 98 schools.

All Saints' parish was more carefully scrutinized than any other part of the borough. Estimating its population at 20,000, the number of children—

Between 3 and 15 was found to be	4352 or 21¾ per cent.
Able to read	3007 or 69 —
Read and write.....	1935 or 44½ —
Unable to read	1345 or 31 —
Unable to write.....	2417 or 55½ —

The number of adults unable to read or write could not be satisfactorily ascertained; but the number of births registered between July 1, 1837, and March 1, 1838, was found to be 243; and 168 of the persons who gave the information made their marks, while 75 only wrote their names, many of which were illegible. The physical condition of most of the schools was stated to be perfectly horrible. They were filthy, dark, ill-ventilated, and miserable; the dame-schools, however, were found to be more clean and orderly than had been expected. The following table shows the statistics of crime in Newcastle, taken from the records of committals, between the 12th of October 1836, and the 24th of April 1838:—

	Males.	Females.	Total.
Under the age of 12	11	11	22
Above 12 and under 14	19	6	25
14 — 17	65	26	91
17 — 21	185	107	292
21 — 30	272	215	487
30 and upwards	205	142	347
Amount....	757	507	1264
Can neither read nor write	243	204	447
Can read only.....	108	125	233
Can read and write imperfectly	377	177	554
Can read and write well.....	29	1	30

Although the general condition of the dwelling-places formed no necessary part of Educational Statistics, Mr. Cargill deemed it right to state, that the agent found many of the dwellings close, dirty, and miserable; whole families often inhabiting a single room, and dwelling in a most pestiferous atmosphere, although the houses were well built, and the rooms might easily be rendered comfortable. In no instance was a cellar used as a place of abode. The inhabitants of the most wretched district, Sandgate, displayed more mildness and intelligence than any other visited by the agent. Most of them were keelmen,* boatmen, jobbing labourers, with some rope-makers, blacksmiths, &c. The rate of wages earned by rope-makers averages one guinea per week, but steady men earn from 25*s.* to 26*s.* per week; common labourers in rope-manufactories 18*s.*; blacksmiths from 21*s.* to 25*s.*; skilful glass-makers 40*s.* per week; and keelmen from 30*s.* to 40*s.* per week. It subsequently appeared, that the best paid labourers and artisans in Newcastle were generally the most improvident.

The discussion on this paper was long and desultory, but no important fact was elicited.

'On the state of Agriculture and Agricultural Labourers in the North Division of the county of Northumberland,' by Mr. L. Hindmarsh.

The population of that division is stated to be 85,178. The part nearest the German Ocean is mostly a fertile clay loam, which, about four miles from the coast, runs into a poor moist clay, which, a few miles farther, terminates in moor land, or heath, after which come a series of fertile valleys to the base of the Cheviot. The climate is very variable,

* A keel is a species of lighter peculiar to the Tyne.

but generally humid, so as so render the district suitable for the growth of green crops. The harvest is a month later than that of the south of Europe. Tillage farms vary from 150 to 1000 acres, and hill farms from 500 to 5000; and in the northern part, large capitals are involved in farming. The average rent of tillage farms is 20*s.* per acre, that of hill farms 2*s.* 6*d.* They are usually let by tender, except in the case of old tenants, who are usually treated with privately: long leases are found to be advantageous. The tenants on the Northumberland estate get a crop of corn before they have any rent to pay, which renders less capital necessary. The land is ploughed by iron swing ploughs, drawn by two horses: the use of artificial manure has greatly increased. The statistics of education in the town of Alnwick may be taken as a specimen of the state of education in the north division of Northumberland. Its estimated population is 7358.

The numbers who attend superior private schools	100 or 1.37 per cent. of popn.	
Common day-schools....	205 or 2.81	—
Borough free-schools....	203 or 2.75	—
Charity-schools	250 or 3.43	—
Dame-schools	74 or 1. 1	—
Sunday-schools only	133 or 1.81	—

The character of the agricultural labourers in this district is well known for morality and industry. Mr. Hindmarsh attributed this to the mode of hiring and paying the hinds. They are hired by the year, and are paid partly in kind and partly in money, so that their employment is constant, and their supply of food certain. The terms for a hind are generally as follows:—Grass for cow in summer, and one ton and a half of hay or straw for winter food; a cottage and garden rent free; 1000 linen yards of potatoes; 6 imperial bushels of wheat; 24 bushels of barley; 36 bushels of oats, and 12 bushels of beans; and from 3*l.* to 4*l.* in cash. For this he gives his year's labour, and agrees to find the farmer either one of his own family, or a female servant, as an out-door worker, at the rate of 8*d.* per day in winter, 10*d.* in summer, and 1*s.* 6*d.* per day in harvest. This latter condition is what is called "the bondage system." From the difficulty in procuring servants, and the high wages they demand, the hinds have long disliked this system, and during last year an abortive effort was made for its abolition. The annual income and expenditure of a family of agricultural labourers, at Chillingham, was then exhibited in detail. The family consisted of a father, mother, and six children; the income amounted to 76*l.* 0*s.* 10*d.*, and the expenditure to 75*l.* 13*s.* 7*d.* Most of the hinds are Presbyterians, and many of them travel several miles on the Sunday morning to service at their meeting-house. Few of their houses are without a Bible, and some popular religious books. Another probable cause of the morality of the hinds is their isolation: few of them live in villages, but they are located in cottages around the farm-head, and, with the farmer, form a colony of themselves. With respect to population, the ratio of increase in the towns and villages is 9 per cent., and in the rural districts only 3 per cent. In Chillingham, taking an average of five years, the deaths are 1 in 165 of the population, while in the the town of Alnwick the deaths are 1 in 49 of the population. Upon the whole, the agricultural statistics of this district are of a gratifying character; they present a soil well cultivated under the vicissitudes and difficulties of a very variable climate, and a peasantry, who, in their general intelligence and moral habits, are a credit to themselves, an honour to the country, and an example worthy of imitation.

Although the discussion on this paper was very brief, it brought under view most of those points in the theory of population which are approaching the fixity of scientific principles. The ratio of increase in a population seems not to be an accurate test of prosperity, and most of those who spoke were of opinion that a community nearly stationary promised better for enjoyment. It was understood, at the close, that some gentlemen would unite to make inquiries on this point, which is an element too much neglected in this department of economic science.

Section G.—MECHANICAL SCIENCE.

Sir John Robison stated that he had omitted, on the preceding day, to mention a circumstance, which he considered of peculiar importance to the lower orders. Mr. Strutt, of Derby, to whom the country owed so much, had some years ago expressed to him an opinion, that coal-gas would be found, by the lower orders, the cheapest fuel for cooking. This he had applied; and the whole apparatus, which might be considered as the converse of the Davy safety lamp, consisted in fixing a piece of wire-gauze at the extremity of a gas-pipe of about six inches diameter. He referred to the account in Loudon's 'Encyclopædia of Cottage Architecture' for some valuable remarks and directions on this subject. The wire-gauze was liable to be destroyed under a long-continued intense heat: this, however, was obviated by sprinkling a small quantity of sand upon it. Bulk for bulk, gas was more expensive than coal, but the former was more economical and convenient for occasional use and the smaller operations in cooking.

'A New Rotatory Steam-Engine,' by S. Rowley.

The inventor being absent, Mr. Evans undertook to bring this before the Section; and having pointed out the construction, stated, that the only novelty in this consisted in the excentric being on the inside. Many present condemned the rotatory engine as mechanically impracticable. Many of the most talented mechanics of this country had given up the attempt after repeated trials. It was argued, that no theoretical advantage can be gained by it; and that though there might be some circumstances under which economy of space and first cost were of such importance that the most expensive wear and tear could be borne, yet no prudent man would purchase an engine which might ruin him in the repairs. It is not sufficient to have a good theory; the powers of mechanical construction must be considered; many inventions which thirty years ago might have been lost, because they were antecedent to the march of the mechanical art, would now, in the wonderfully advanced state of this art, be generally introduced.

'Report on Railway Constants,' by Dr. Lardner.

Dr. Lardner stated, that at the last meeting of the Association a sum of money had been voted for the purpose of ascertaining certain railway constants,—that is, the force of traction on a level plane; the resistance due to friction, to curves, to the atmosphere; how the force of the wheels and the carriages influenced the motion. He then explained the causes which had prevented the experiments being made, and that, consequently, he had nothing to report as experimentally determined on the above subject; but that he had that instant received a set of experiments on the above subjects, made, at his request, by Mr. Woods, the resident engineer of the Liverpool and Manchester Railway, a young man whose excessive modesty alone prevented his occupying the position which his talents could claim. Some of these results, especially those relating to the effect of the resistance of the atmosphere, he then alluded to. He then described the various methods which had been proposed for the determination of the constants in question. These differed in no respect from the statements which were made last year at Liverpool, and which were then fully reported in our pages (see *Athenæum*, No. 518). He also described a dynamometer, by which the traction might be measured with considerable accuracy; and concluded, by adverting to the great experiment which was now trying on the Great Western Railway, with respect to the gage of seven feet instead of four feet eight inches.

TUESDAY EVENING—MODEL ROOM, CENTRAL EXCHANGE.

This evening was devoted to the description and explanation of some of the most remarkable mechanical models, exhibited during this meeting at the rooms of the Central Exchange; but as it was not known until a late hour what models would be selected for illustration, our report of the proceedings must be brief, because, descriptions of complicated machinery cannot be understood without numerous diagrams, and there has been no time for procuring the necessary drawings.

Prof. Babbage, said, that when at Berlin, ten years ago, he was present at one of the German Associations, in which the sciences and arts were equally represented; and so delighted was he, that he laboured to impart a share of his pleasure to his friends, and, from the letters he then wrote, the first impulse was taken, which led to the formation of the British Association. The object of the institution was, to form a bond of union between the practical mechanic and the man of science, and to increase human happiness by enlarging the sphere of intellectual pleasure, for every new developement of intelligence was a source of pure enjoyment. The bond of union was the love of knowledge; there is an equality in science, for the great requisite is, not the amount of information, but the desire to be informed. The Association was a triumph of peace, more valuable and glorious than any which war could afford; its benefits were not confined to Britain, for every advancement in art and industrial processes here was felt in every part of the globe. Science is merely common sense, and there was no improbability in uninformed minds attaining the same results from the simple dictates of common sense, as the philosopher resolved by mathematical deductions. The models collected in the exhibition room were interesting, not merely to the mechanist, but to the higher classes, for it must be a great source of pleasure to know how the various articles of luxury and ornament were produced. The subjects which he had undertaken to illustrate, were the arts of engraving on copper and wood, and of taking impressions from hollow and raised plates or blocks. He then showed by models and diagrams, that the great difficulty in wood engraving or the raised die, was to obtain black lines crossing each other, and in copperplate to obtain white lines crossing each other. Having noticed various mechanical contrivances for overcoming these difficulties, he described the art of printing in colours from wood blocks, and directed the attention of the members to specimens sent to the model room by Mr. Knight, declaring that the exertions of that publisher were likely to bring all the processes of wood engraving to a degree of perfection without parallel and beyond expectation. He then mentioned a process, by which, in the raised die, black lines crossing each other had been obtained; a polished brass plate was thinly covered with plaster, and on this surface the process of sunk engravings could of course be easily performed, and then by taking a cast, the raised engraving might be obtained. He directed attention to the advantages resulting from the multiplication of engravings by the stereotype process, and particularly mentioned its application to the representation of the parts of machinery in detail. The Professor concluded by directing attention to a detector lock, which had been placed in the model room, but stated that its merits could only be understood by inspection.

The Rev. Dr. Robinson, of Armagh, then addressed the meeting. He felt great difficulty, he said, in following a person of such eminence as the President of the Mechanical Section; but when he looked at the model which he had undertaken to illustrate, that of the wooden viaduct over the Ouseburn, he felt that its architect was fairly entitled to the reward offered by the tyrant of old for the invention of a new pleasure. The stupendous edifices of Egypt, the splendid architecture of Greece, when compared with a bridge, were but specimens of magnificent barbarity. Although the art of constructing bridges had been long known, yet recent events had given it new developements; the destructive agents, fire and water, had been pressed into our service, and compelled to minister to our wants: like the evil spirits in the Arab tales, they had been forced to become slaves of the lamp and the ring, and to obey the behests of the magician. Dr. Robinson then entered into a minute history of the various contrivances employed for bridges, which he illustrated by models, from the simple plank and rope, to the bridge of Schaffhausen, and the structure over the Ouseburn. In the latter, he said, a new element had to be provided for: the architect had not only to provide for the transit of weight, but for that of bodies coming with the velocity of the lightning, and the resistless force of the thunderbolt: stone could not be used in its construction, for the extensive mines in the vicinity might render the foundation insecure: iron was so elastic that it might suddenly break from the intensity and rapidity of the shock given by the locomotive engines. He then pointed out all the contrivances in the structure for the distribution of stress, assigning the use of almost

every beam. He said that many might be inclined to lament that such an edifice had been built with perishable materials, but by a recent discovery—which, perhaps, more than any other, illustrated the connexion between the sciences—wood had been rendered durable. He then minutely described the Kyanizing process, with which, of course, our readers are familiar. In conclusion, he stated that this single structure amply redeemed the promise which Prof. Johnstone, of Durham, had made at Liverpool, respecting the advantages which the Association would derive from a visit to Newcastle.—[For a minute description of this bridge, see our report of objects best worth seeing in the neighbourhood of Newcastle, *ante*, p. 573.]

Prof. Willis then exhibited a model of a new locomotive engine, and explained all its parts. It would be impossible to follow him without the aid of numerous diagrams; and we must be content with saying that the merit of the new engine consists in its having a contrivance for changing the direction of the valve without an excentric motion on the shaft.

OUR WEEKLY GOSSIP.

We have little room for Gossip this week—indeed our whole thoughts and attention have been directed to the meeting of the British Association. Our readers will observe with satisfaction that Her Majesty has graciously conferred the honour of knighthood on that enterprising navigator and distinguished northern traveller, Captain Back; and that the scientific men assembled at Newcastle testified their satisfaction at seeing honours so worthily bestowed by electing Sir George Back Vice-President of the Geographical Section. A like honour was, at the same time, conferred by her Majesty on Capt. J. E. Alexander, just returned from Africa, and the account of whose expedition is now before us, and will be published in a few days. We also hear from Newcastle that, by the death of Baron Hume, a very valuable collection of MSS. has within these few days come into the hands of Sir James Robison, as Secretary of the Royal Society of Edinburgh. They consist principally of letters addressed to David Hume, from Rousseau, Condamine, and other distinguished foreigners, with a few letters written by Hume, and returned under various circumstances, together with several MS. essays and works. We can only express a hope that such a collection will be forthwith published, and that the Royal Society of Edinburgh will take care that no editor to whom they may be intrusted be allowed to exercise any party feeling, either by suppression or mutilation.

We have authority to state that His Royal Highness the Duke of Sussex has signified his intention of resigning the President's chair of the Royal Society at the close of the year. Although, from the state of his eyes, His Royal Highness has been for some time prevented from attending the meetings of the Society, his general urbanity and kindness during the time he has filled the office will long be remembered by the Fellows. As this His Royal Highness's intention is not yet publicly known, we have, of course, not heard even a conjecture as to his probable successor, but presume there can be no doubt on the subject.

DIORAMA, REGENT'S PARK.

This Establishment will be SHORTLY CLOSED, arrangements having been made for sending the two Pictures now exhibiting abroad. They represent TIVOLI, with a View of the Cascades, and the Interior of the BASILICA of ST. PAUL, before and after its destruction by fire. Painted by Le Chevalier Bouton. Open from Ten till Five o'clock.

POLYTECHNIC INSTITUTION,

NOW OPEN, 309, REGENT-STREET, near Langham-place, extending into Cavendish-square.—The Great Hall has a surface of 700 feet of water, in which a Diver is at work, and into which a Diving-bell descends with four or five persons.—In the extensive Rooms are arranged the most interesting Models and Machinery, some of which are in motion by Lord Dundonald's Rotary Steam Engine.—A magnificent Hydro-Oxygen Microscope by Carry, and many interesting Works of Art.—Open daily from Ten o'clock to Six o'clock.—Admission, 1*s*.

N.B. A Lecture on some Scientific subject delivered every day at 2 o'clock.

TO CORRESPONDENTS.

The accounts of preceding Meetings of the British Association having been reprinted, may still be had. The Reports of the Proceedings and Papers read at Dublin, are contained in the Monthly Parts for August and September, 1835; Bristol, August and September, 1836; Liverpool, September and October, 1837.

ADVERTISEMENTS

UNIVERSITY OF LONDON.

Somerset House, Aug. 16, 1838.

A MATRICULATION EXAMINATION will be held at the Apartments of the University, commencing on the 5th of NOVEMBER NEXT. The Regulations adopted by the Senate on the subject of these Examinations may be had on application to the Registrar, at the University.

UNIVERSITY OF LONDON.

Somerset House, Aug. 23, 1838.

NOTICE IS HEREBY GIVEN, That on WEDNESDAY, the 26th September, the Senate of this University will proceed to elect,

Two Examiners in Mathematics and Natural Philosophy.
One Examiner in the French Language; and
One Examiner in the German Language.

These Examiners will conduct the Matriculation Examination, and the Examinations for the Degrees of B.A. and M.A.

They will continue in office for one year from the time of their appointment.

The Examiners in Mathematics and Natural Philosophy will receive 200*l*. each from the University Chest.

The Examiners in French and German will receive 20*l*. each, for each Examination.

Further Particulars may be learned by application to the Registrar at Somerset House.

By order, R. W. ROTHMAN, Registrar.

UNIVERSITY COLLEGE, LONDON.

FLAHERTY SCHOLARSHIP, 1838.

Students who intend to be Candidates for the FLAHERTY SCHOLARSHIP of this year, which will be awarded by Examiners appointed by the Council of the College to the best Proficient in MATHEMATICS and NATURAL PHILOSOPHY, are informed that the EXAMINATION will take place in the second Week in October, the result to be announced on or before the 1st of November. They are required to make known their intention to the Council on the 1st of October at the latest. The regulations adopted by the Council, respecting the Examinations for these Scholarships, will be furnished to Candidates on their applying at the Office of the College. In the year 1839, the Flaherty Scholarship, 50*l*. a year, tenable for four years, will be awarded to the best proficient in Classics. Students matriculating to the College in October 1838, being in other respects qualified, will be admitted to competition, in common with those of preceding years.

EXAMINATION FOR DEGREES.—Students of this College who desire to be admitted to the Matriculation Examination of the University of London, which is appointed to commence on Monday the 5th of November next, should present themselves at the College on or before the 1st of October, to make arrangements for obtaining the College Certificate, required by the regulations of the University.

It has been announced by the senate of the University that Examinations will take place once a year, in May or June, for the Degrees of Bachelor of Arts and Master of Arts; and once a year, in November, for the Degree of Bachelor of Laws. That Exhibitions of 30*l*. a year, for two years, may be obtained by Students, under nineteen years of age, who shall have passed the Matriculation Examination, and in a subsequent Examination for Honours, shall most distinguish themselves in Mathematics and Natural Philosophy, or in Classics. And that University Scholarships of 50*l*. a year, for three years, may be obtained by Candidates, under twenty-two years of age, who shall have passed the Examination for B.A. or B.L., and, in a subsequent Examination for Honours, shall most distinguish themselves in Mathematics and Natural Philosophy, Classics, or Jurisprudence respectively.

The Session 1838–39 will commence on the 1st of October for the FACULTY OF MEDICINE; on the 18th of October for the FACULTY OF ARTS. For the JUNIOR School on the 25th of September.

Prospectuses will be supplied on application to the Office of the College.

August 21, 1838. CHARLES C. ATKINSON, Sec.

UNIVERSITY COLLEGE, LONDON

JUNIOR SCHOOL.

Head Masters.

THOMAS H. KEY, A.M. Prof. of Latin in the College.
HENRY MALDEN, A.M. Prof. of Greek in the College.

The SCHOOL will OPEN on Tuesday, the 25th of September.

The Session is divided into three terms—viz. from the 25th of September to Christmas, from Christmas to Easter, and from Easter to the 3rd of August. The yearly payment for each Pupil is 15*l*., of which 5*l*. are paid in advance each term. The hours of attendance are from a quarter-past Nine to half-past Three on the first five days of the week, and to a quarter-past Twelve on Saturdays.

The subjects taught (without extra charge) are Reading, Writing; the properties of the most familiar objects, natural and artificial; the English, Latin, Greek, French, and German Languages; Ancient and Modern History; Geography, both Physical and Political; Arithmetic and Book-keeping; the Elements of Mathematics and Natural Philosophy; and Drawing. Any Pupil may omit Greek and Latin, or Greek only, and devote his whole attention to the other branches of education.

There is a general Examination of the Pupils at the end of each Session, and the prizes are then given. The discipline of the school is maintained without corporal punishment.

A monthly report of the conduct of each Pupil is sent to his Parent or Guardian.

Further particulars may be obtained at the Office of the College.

21st August, 1838. CHARLES C. ATKINSON, Sec.

N.B.—Mr. Wright, 36, Tonbridge-place, Mr. Hardy, 32, Mornington-crescent, Hampstead-road, Mr. Haselwood, 20, Upper Gower-street, and Mr. Behan, 16, Euston-square, receive Boards.

☞ Lectures in the Classes of the FACULTY OF MEDICINE commence on the 1st of October, those of the FACULTY OF ARTS on the 15th of October.

UNIVERSITY COLLEGE, LONDON.

JUNIOR SCHOOL.

Mr. HASELWOOD, Private Tutor and Assistant Master at the University College School, RECEIVES, under the sanction of the Head Masters, a SELECT NUMBER of YOUNG GENTLEMEN as Boarders, to be educated in the School of the College. Terms for Board and Private Tuition 45 Guineas per annum. Each Pupil has a separate bed. The number being limited, a term's notice is required prior to removal. The house adjoins the play ground of the College, to which (with permission of the Council) a communication has been opened for the Pupils' recreation.

Further particulars may be obtained by letter (post paid) addressed to Mr. Haselwood, 20, Upper Gower-street, Bedford-square.

CENTRAL SOCIETY OF EDUCATION.

PRIZE ESSAY.—The Prize offered by this Society for the best Essay upon 'The Expediency and Means of Elevating the Character of the Educator in the Estimation of the Country,' cannot be awarded before the British Association shall have terminated its proceedings at Newcastle-upon-Tyne, in consequence of the labour thrown upon the Arbiter being much more serious than was anticipated.

B. F. DUPPA, Honorary Secretary.

MARYLEBONE LITERARY and SCIENTIFIC INSTITUTION, Edwards-street, Portman-square.

The LECTURES for the Season will commence on MONDAY, Sept. 3rd, with a Course on HYDROSTATICS, by Mr. Addams; to these will succeed Lectures on the MINOR POETS, by Mr. Cowden Clarke; and on MUSIC, by Mr. Holmes.

Terms of Subscription for the Lectures, Reading Rooms, Library, and Literary Meetings, Two Guineas per Annum.

Classes for Instruction in French, Italian, Drawing, Chemistry, and Music. G. H. GARNETT, Hon. Sec.

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This Cabinet is the product of thirty years' studious attention to the new disclosures; the Specimens have been all carefully selected, many of which are very rare, and a few perfectly unique, containing the most interesting Animal and Vegetable Remains of Great Britain, nearly all the known *Belemnites* and *Orthoceratites*, as well as a very complete series of Encrinital Remains, contained in ten separate drawers, including nearly all that are now known, and embracing a selection of not less than 224 heads, with the entire series of beautiful Specimens of the *Bradford Encrinites*, to which are added a very few foreign ones from Germany. The whole of the Encrinital Remains are also numbered and catalogued, with a description of each Specimen, from the Chalk to the Schist.

The number of Specimens, including the Encrinital Remains, are 4728, as per catalogue; but in this number are not included many interesting varieties deposited in the trays, and not catalogued, which would nearly double the amount.

They may be viewed by any person desirous of making such a purchase, on application to Mr. Cumberland, at his house, Culver-street, Bristol; letters to be post paid.

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